American Machinist

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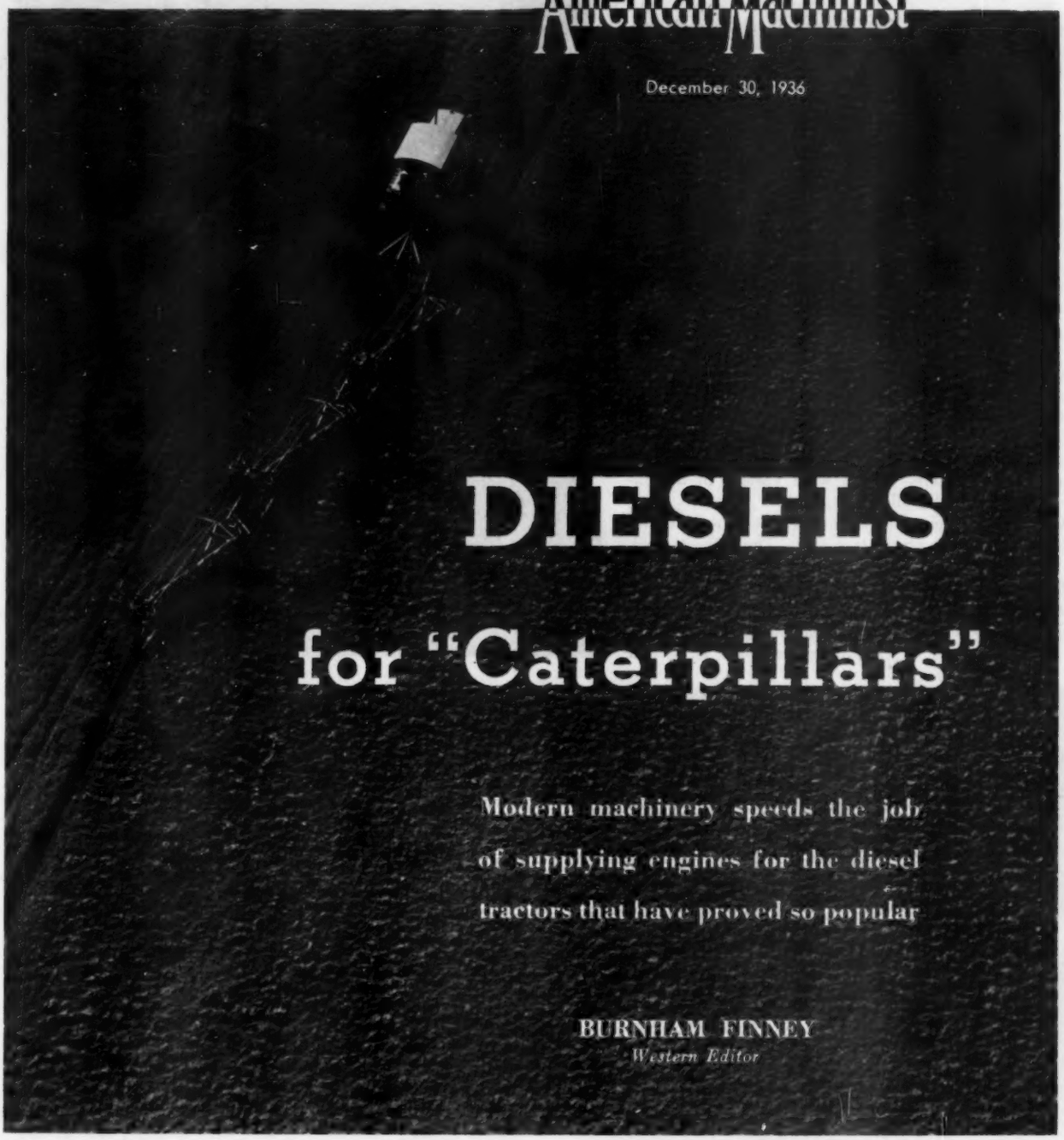


DIESELS for "Caterpillars"

Modern machinery speeds the job of supplying engines for the diesel tractors that have proved so popular

BURNHAM FINNEY
Western Editor

GROWTH in demand for diesel engines by industry and agriculture has been especially notable in what might be termed mobile or portable applications. In the fall of 1931 the Caterpillar Tractor Company began production of a diesel-powered tractor. By November 1935, or four years later, it had built its ten thousandth diesel engine. In October 1936 its total diesel output passed the 20,000 mark.

Only a year or two ago "Caterpillar" tractors were powered largely by gasoline engines, yet today nine out of ten purchasers specify diesel engines and pay more money for them. "Caterpillar's" diesel business is drawn from construction, road maintenance, agricultural and miscellaneous industries. The diesel trend is traced to the lowering of weight per horsepower, to the development of stronger and tougher alloy metals, and to the increased precision with which diesel parts and assemblies are made.

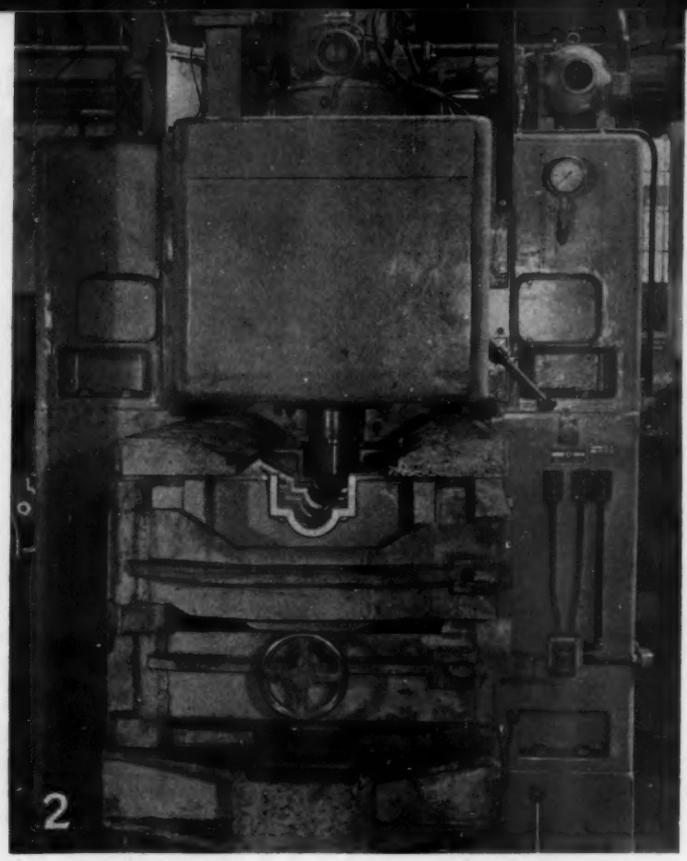
"Caterpillar's" diesel business has grown so fast that the company has had difficulty keeping factory capacity abreast of sales requirements. Hundreds of thousands of dollars have been expended for new high-production equipment for machining parts within extremely close tolerances. Less than a year ago a new power assembly conveyor line was installed for assembly of all diesel engines except the 160-hp. V-eight, which has a new assembly setup of its own. More recently a complete new line for machining cylinder blocks has started operation.

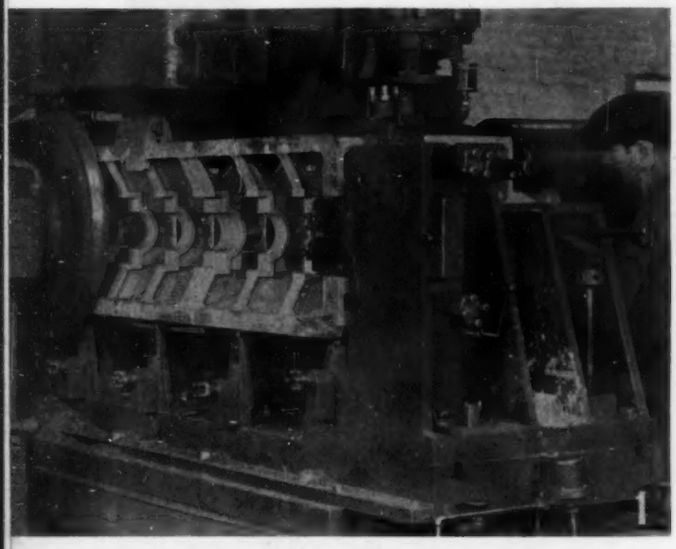
"Caterpillar's" manufacturing problem is complex, partly because of the size of the diesel power plants produced. The cylinder block alone of the six-cylinder diesel engine weighs 1,200 lb. Despite the wide variety of diesel engine sizes made by "Caterpillar,"

production has been simplified to an unusual degree. Assembly methods resemble those in the automobile industry, except that the unit size is larger and the number of units built is smaller. Floor space has been expertly utilized with no effort to crowd workers into too small an area. The entire cylinder block line occupies only 8,400 sq.ft.

"Caterpillar" has five different diesel engines. It also builds two spark ignition engines suitable for burning gasoline, kerosene, alcohol or natural gas. Two of the diesels are four-cylinder motors, one a six-cylinder, one a three-cylinder and one a V-eight. Dimensions of the bore and stroke of all motors, except the small four, are 5¾ in. x 8 in.; those for the small four are 4¼ in. x 5½ in. Maximum horsepower ranges from 44 for the small four up to 160 for the V-eight. A standard "Caterpillar" diesel power unit consists of engine (fan to flywheel inclusive), radiator, fuel tank, controls, hood without doors, and clutch with extended drive shaft mounted in two pillow blocks, all assembled on a steel channel base. Diesel engines are also available alone, with a wide variety of attachments for special applications.

Cast iron cylinder blocks for diesel engines are machined on the new production line. The biggest block is the six-cylinder one weighing 1,200 lb. A four-cylinder block weighing 900 lb. also goes down this line, as well as a three-cylinder block 700 lb. in weight. Wherever possible, machines are built into the conveyor line so that no extra work is needed to get blocks into the machines and from one machine to another.





(1) Top, bottom and pads of the diesel block are milled simultaneously in a three-spindle machine

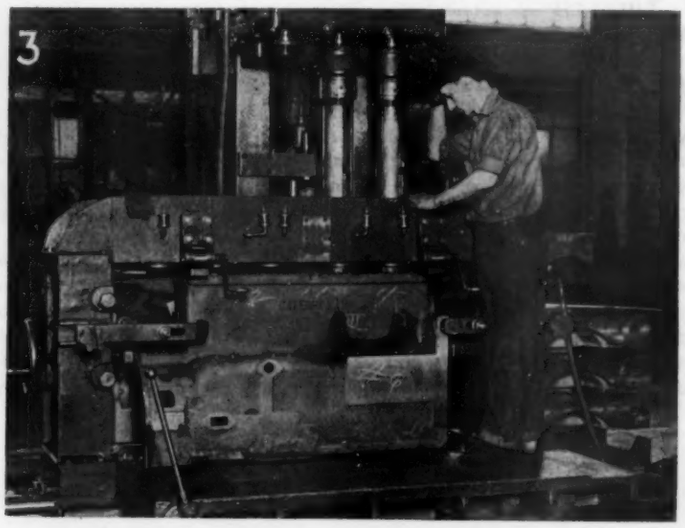
(2) A new special mill roughs and finishes the bearing seats on the large cylinder blocks

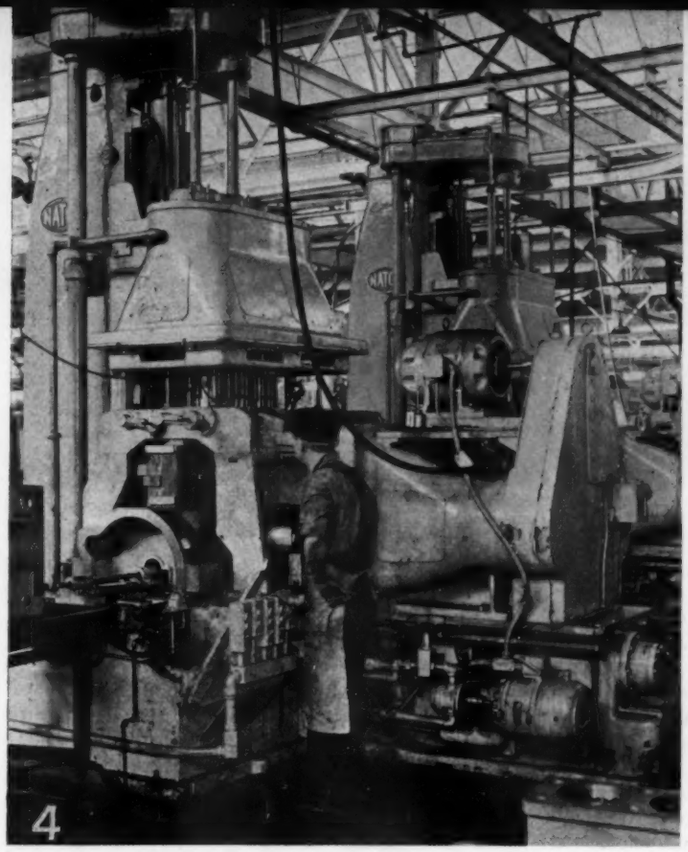
(3) Four-cylinder blocks are bored, two holes at a time, for cylinder liners; a third spindle is available for three and six-cylinder designs

Initial work is to mill the top, bottom and pads on the sides of the blocks on a special Newton three-spindle milling machine. Two locating holes are drilled and reamed on a Cincinnati Bickford radial drill, after which blocks pass to a special ram-type Newton miller for rough and finish milling the sides and top of the main bearing locks and between the main bearings. The milling of one surface on the front end of the block and two surfaces on the rear follows on a two-way Newton milling machine. Crankshaft bearings are rough bored on a line boring machine designed by "Caterpillar's" engineers.

Cylinder liner holes are bored on a special three-spindle Barnes vertical boring machine. All three liner holes in the three-cylinder block are bored at one pass. Two passes are necessary for the six-cylinder block. When the liner holes in the four-cylinder block are to be bored, one spindle of the machine is removed and boring is done two holes at a time. The fixture on this machine automatically indexes.

Four heavy-duty Natco hydraulic-feed, adjustable-spindle drilling machines, three of which are arranged with horizontal hydraulic drilling units, are used to perform all the drilling, core drilling and counterboring operations on the top, bottom and both sides of the cylinder blocks. A fifth machine, a large two-way Natco, drills the two ends of the blocks. The first two machines in the Natco battery drill the top face and straight side of the





The Natco machine for drilling the top face and straight side of the block is a standard vertical hydraulic driller arranged with an Oilgear semi-automatic hydraulic feed. The operator has control of the machine by means of a single push-button station. The head has a drilling area of 22x38 in. and is arranged with 34 universal joint spindle drives. The head is of standard Natco two-speed construction, providing two speeds and neutral for each spindle. Used in connection with this head is a slip spindle plate bored for 33 spindle centers and arranged with one geared section containing two spindles with nose adjustment. Thirty-three standard slip-type spindles also are furnished.

Bolted to the front face of the fixture base is a Natco hydraulic unit mounted horizontally. This unit has a 22x38-in. head complete with 24 universal joint spindle drives. The head is of the standard fixed-change-of-speed construction which insures a fixed speed for each spindle. Mounted under the vertical head and in front of the horizontal head is a two-position roller conveyor type of fixture designed to hold any one of the three cylinder blocks. Production is about eleven blocks per hour. Three other Natco machines are similar in design to the one described.

The two-way horizontal hydraulic driller is built of two Natco hydraulic units, each complete with a head having a drilling area of 22x38 in. Each head is of the standard Natco change-of-speed construction

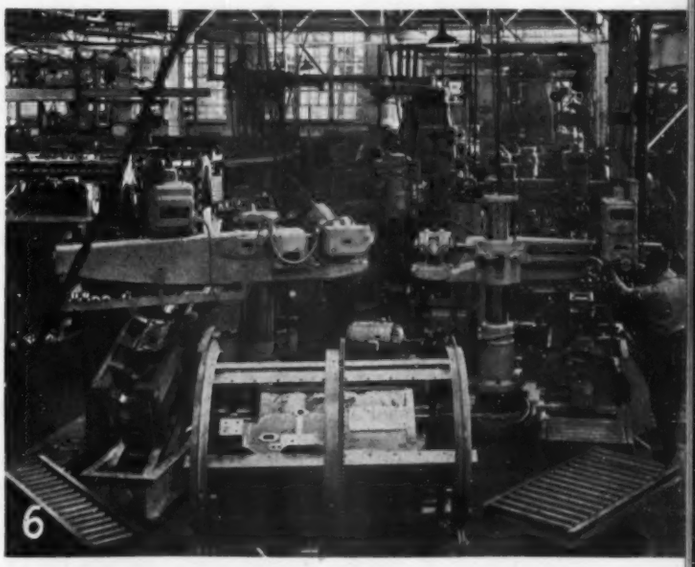
block. After both ends are drilled on the two-way machine, the bottom of the block and the other side are drilled. The three-cylinder block does not pass through this machine, going instead through a special "Caterpillar" designed machine for drilling holes in the bottom and two sides. All blocks move through a Natco machine to have the balance of the flange holes drilled in the bottom. The remainder of the tie rod and lock holes are drilled in the bottom of the block on a Natco.

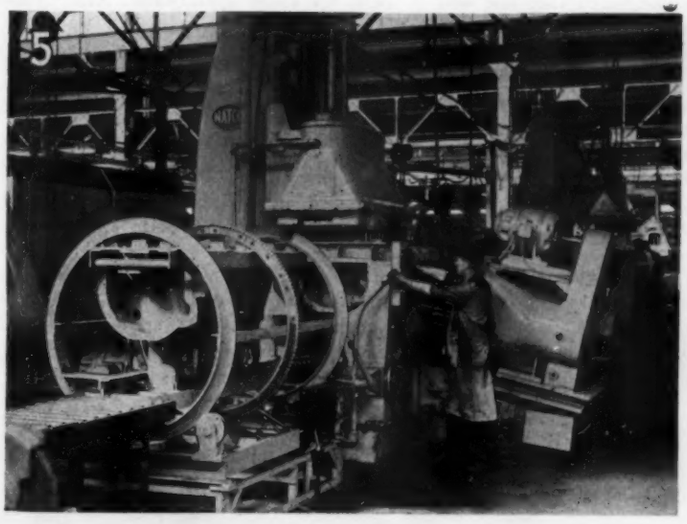
All the Natco machines are arranged with stationary roller conveyor type fixtures. Blocks are located against the bottom face and over pins in the master locating hole and bearing lock. Where two settings are needed to perform the necessary operations, a second set of plugs provides location.

(4) Two multiple-spindle machines drill the top face and straight side of the block

(5) A roll-over fixture positions the work for operations on the bottom and angular side

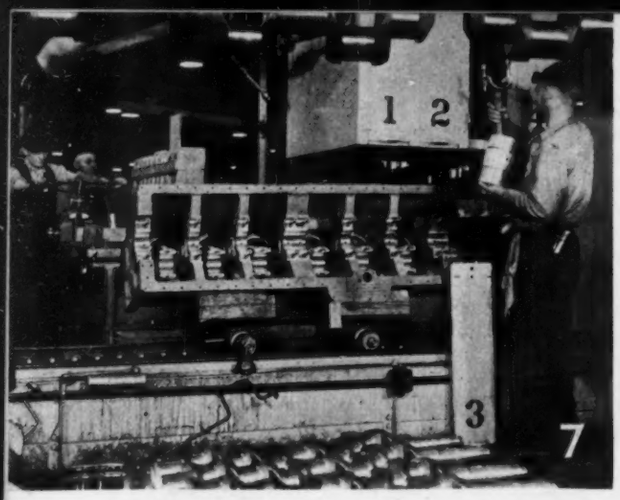
(6) Convenience of work and tool handling features this battery of radials; note the tool racks mounted back of the drill arms and the work positioning devices

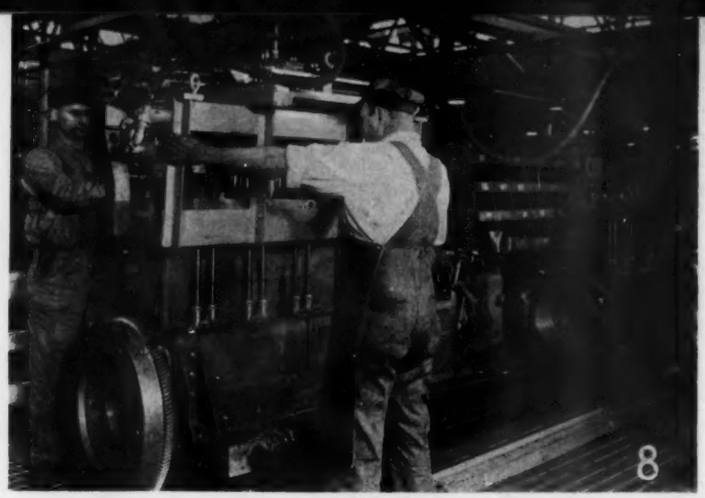




which provides a fixed speed for each spindle. The left-hand head is arranged with 21 universal joint drives and the right-hand head with 27. Used in connection with the left-hand head is a slip spindle plate bored for 25 spindle centers and arranged with one geared section containing two spindles with nose adjustment. Also furnished with the head are 21 slip type spindles complete with nose adjustment, nine of which have eccentric bearings. The right-hand head has a slip spindle plate bored for 20 spindle centers and arranged with two geared sections. One geared section contains eight spindles and the other five. This head has 20 slip-type spindles complete with nose adjustment. Mounted between the heads is a stationary disappearing roller conveyor type of fixture.

After passing through the Natco machines the





blocks go on a conveyor through one Carlton and six Cincinnati Bickford radial drills, each with hydraulically-operated holding fixtures for all tapping, reaming, spot facing and back facing work. After moving through a special washing machine, which removes all chips and dirt, blocks go to a station where the tie rods and main bearing caps are assembled. The crankshaft and camshaft bearings then are line bored in a special Barnes horizontal boring machine. Blocks again are washed. Cylinder liners are assembled in the blocks, and the blocks are given a thorough water test. Bearing caps are removed, and the main bearing shells assembled. Blocks go to a "Caterpillar" boring machine to line bore the main bearing shells.

Dollies for Assembly

After the machining work is completed, blocks are rigidly inspected and transferred by air hoist a distance of 80 ft. to the beginning of the assembly line. This line is of the continuous chain type running between two narrow gage rails and is equipped with dollies on which the engines are assembled. The dollies are of special design, indexing in six horizontal positions. Portable overhead equipment along the line is mounted on automatic spring-type balancers so that the operator is relieved of lifting any considerable weight. At one point along the line is a special air lift to raise the motors from a horizontal to a vertical position. The conveyor line has four speeds which can be varied according to the volume of production.

All of the various sizes of diesel engines, as well as a small four-cylinder gasoline engine somewhat similar to the diesel four, are assembled along this one line. Because of the standardization of design which provide the three larger diesels with the same bore and stroke, their parts are identical. The two small fours, one a diesel and the other a gasoline engine, are the same up to the point where the diesel receives a fuel injection assembly. Even the tractor and road machinery power units are identical in most respects.

Scheduling of production has been simplified too. The foreman of the assembly line receives a daily order stating the number of engines of each type to be built, while the machining departments are notified in advance of this schedule so that they will machine the proper numbers of each block. An adequate bank of small parts to fit all engine sizes is kept along the line. Workmen have cards showing which part to use in each kind of engine, but quickly familiarize themselves with these details so that they do not have to refer to them. Assemblies of such parts as pistons are made up right along the line slightly in advance of the arrival of the engine at a given point.

There are four sizes of chrome-nickel iron cylinder heads for "Caterpillar" diesel engines. One is for the small four-cylinder motor, a second for the three-cylinder and six-cylinder motors, a third for the large four-cylinder motor and a fourth for the V-eight motor. In addition there are five heads of different sizes for gasoline engines made by "Caterpillar." The multiplicity of cylinder heads might appear to present a production problem, but "Caterpillar" has solved it nicely by having all heads for diesel engines, except the ones for the small four, go down one machining line and gasoline engine cylinder heads, plus the head for the small four-cylinder diesel, progress along a second line. A roller conveyor runs between and parallel to both lines and feeds them materials. Both lines are so laid out that a minimum of handling is necessary.

Outstanding equipment in connection with cylinder head production consists of two Newton rotary milling machines which mill the top, bottom and two sides of the cylinder heads. Each machine has twelve stations and each station has three sets of fixtures. Every time the machine indexes, three finished heads are produced. Work is transferred from one station to another manually. Each Newton machine is in charge of an operator who also runs a Cincinnati horizontal milling machine for milling the pads on both ends of the cylinder head.

Removable cylinder liners made of special chrome-nickel cast iron, heat-treated to a high degree of hardness, are used in the cylinder blocks. These liners come to the machining department from the "Caterpillar" foundry. From the time it is put on a gravity feed roller conveyor until it is completely machined, the liner is not set on the floor or placed in a tote box.

Operations on Liner

First operation is to turn the outside diameter on Lodge & Shipley Duomatic lathes specially tooled for this job. The inside diameter of the liner then is rough bored on a four-spindle Barnes vertical boring machine, four liners being bored simultaneously. After heat-treatment to a hardness ranging from 42 to 48 on the Rockwell C scale, the liner goes to a Lodge & Shipley lathe for finish turning and then to a Barnes machine to be finish bored prior to honing. A mirror-like finish on the inside of the liner is secured by honing; two Barnes machines equipped with Micromatic hones are used for rough honing and two machines for finish honing. The hones were especially built for these operations. After honing, the outside diameter of the liner is ground on a battery of three machines. The tolerance for both the inside diameter and the outside diameter is 0.001 in.

The liner is 15 in. long, the outside diameter 6¾ in. and the inside diameter 5¾ in. Tungsten carbide tools are employed for the turning, boring and facing work. Production on most of these jobs is about eight an hour. Rough boring is an exception, witih the output at twelve an hour.

A two-cylinder vertical-type gasoline engine is used as a starting motor for

the diesel engines. The cylinder block and the oil pan for this engine are machined together in a total of seventeen operations, consisting mostly of drilling, tapping, facing, boring, honing, and lapping of the valves. A roller conveyor line has been installed to handle the work. The cast-iron block passes first through a duplex Milwaukee milling machine for the simultaneous milling of the top, bottom, both ends and both sides. Cylinder bores are rough and finish bored on a four-spindle Moline vertical boring machine. Rough machining is done with two spindles, after which the work is transferred to the other two spindles.

Both ends of the block are drilled in a Natco multiple drilling machine, passing to a special Barnes horizontal boring machine for rough and finish boring of the crankshaft and camshaft bearings. This machine has a special head and indexing fixture to carry the tools. All holes in the top, bottom and both sides of the block are drilled on two standard Baker vertical drills equipped with specially-built multiple drilling heads. Tapping operations are done on radial drills. After a rigid water test, cylinders are lapped on a No. 12 Moline lapping machine. The main bearing and camshaft bearing bores are bored on a special line boring machine. It is notable that only 30 min. elapses from the time a starting engine block is put on the line until it is completely machined.

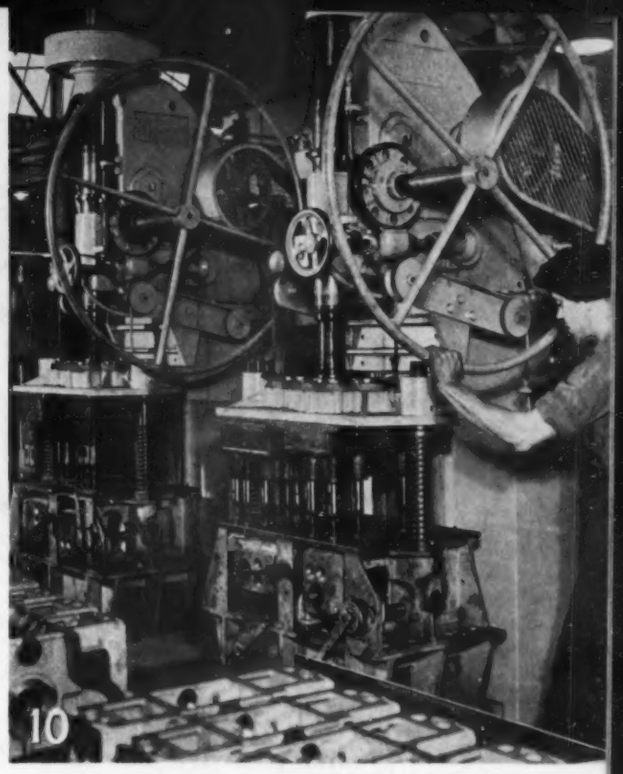
(7) Piston assemblies are kept in a dust-proof compartment until the moment of installation in the block

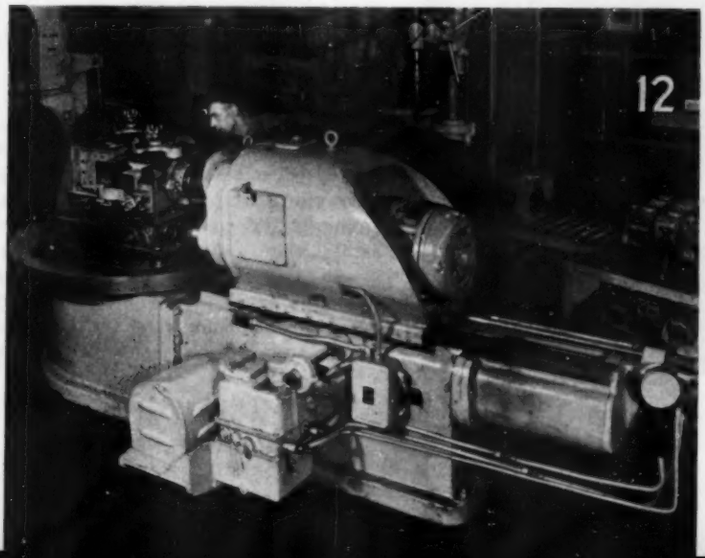
(8) Progressive assembly is expedited by a machine that tightens units pneumatically

(9) Cylinder liners are also handled on roller conveyors past a battery of our machines which rough and finish hone the bores

(10) A pair of vertical drills put all holes in the starting engine block

(11) A special fixture holds the starter engine block while its cylinder bores are lapped





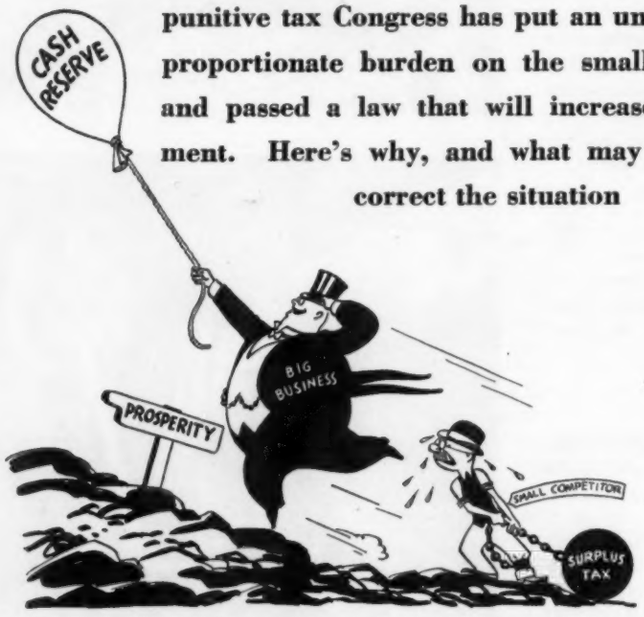
(12) Camshaft and crankshaft starter engine bearings are rough and finished bored in a horizontal machine with special head and fixture

HERMAN H. LIND

General Manager, National Machine Tool Builders' Association

The SURPLUS TAX LAW

In attempting to correct an abuse by levying a punitive tax Congress has put an unfair and disproportionate burden on the smaller business, and passed a law that will increase unemployment. Here's why, and what may be done to correct the situation



FOR YEARS the problem consistently confronting every one has been that of employment, or its reverse, unemployment. When employment is good people are happy and business prospers. When employment for men in industries is up, total wages are up, releasing increased buying power for factory and farm products, and opening more forms of employment. The expression, "the country is prosperous," is a short way of saying there are jobs for all who want them. On that premise, then, it is worth while to speculate regarding the effect of the 1936 Surplus Tax Bill on employment.

The employment of men in an industry is dependent on a market for the product manufactured and the capital to undertake its production. For instance, a man ambitious to embark on a new enterprise in manufacture must first determine upon a marketable product. He must then provide equipment for production—and he must house his equipment by either renting or purchasing a building. He must also reserve enough money to develop his product, plan his method of production, and buy materials; and then he needs some more money to finance the first payrolls and sales expenses. If our new manufacturer has enough funds of his own, he may take all the risks himself. If he is long of ideas and short of funds, he estimates the total amount of money required for the initial investment and financing of the volume of business he hopes to do, and endeavors to interest friends and acquaintances in his venture. If they have money and look on the venture favorably, believing there is a good chance to keep their investment intact and a fair chance for profit, they may go along with him. So the new company is started on its way.

No matter how small or large an enterprise is planned, the procedure is the same. There must be money on hand to be converted into buildings, machinery and equipment—termed invested capital; there must be money for the development, manufacture and distribution of the product—working capital. Not until the invested capital and the working capital are provided can there be employment.

The incentive to create new enterprises will persist so long as there are people who want the things that fashion a higher standard of living. In this country the desire for more and better goods has no limit—houses, clothing, more and better food, automobiles, radios, furniture, good roads, household appliances—there are wants for all these things and for still more goods not yet designed. Granted the incentive to produce things, the satisfaction of all these desires is possible only through the expansion of present industries, or the starting of new enterprises. In either case there follow opportunities for additions to employment.

Practically every successful business had a modest beginning. Early profits were retained and converted into additional capital in the business. By careful management costs were progressively reduced and markets enlarged. As the capital grew, and as it was successfully put to work, employment increased. This procedure is known as "plowing back earnings." Every one knows of some industries in his own community that have such a history.

Strong Companies Immune

Some of the companies that have plowed back their earnings consistently have grown to great size and financial strength. Along with their invested capital they have built great cash reserves. They could expand further and still have funds enough to meet any probable contingency without resorting to borrowing money or the sale

of additional stock. For these strong companies the new tax law holds no immediate terrors. Their greatest growth is behind them; they need only hold their own. They can afford to pay out practically all their profits in dividends and thus save in taxes.

However, their number is small, in relation to the total number of tax-paying enterprises, and in spite of their great size they employ only a small percentage of the total number of gainfully employed. Thousands of small enterprises that had expected to apply the same healthy growth-from-within policy find themselves under the new tax law forced either to pay out their profits in dividends, or, as a fine for reserving a portion for growth, to pay up to twice the proportion of taxes paid by the strong companies whose cash surpluses enable them freely to disburse all they have made this year. Just the reverse of the design of the personal income tax, which is to tax according to ability to pay, the surplus profits tax penalizes those who can least afford to pay out the cash in dividends or taxes.

—and Unemployment

Generally speaking, re-employment from the depths of the depression has taken place most rapidly in those industries that previously were well established; especially those which had in reserve cash to finance improvement of their products and rehabilitation of their equipment. Such companies are operating almost to capacity now. Further additions to employment would now come from the expansion and improvement in smaller businesses and through the establishment of new enterprises. However, the active small business is in a distinctly disadvantageous position as compared to a financially able competitor. Owners of a small business must constantly try to improve their competitive position through lowered costs, improved product, and efficient equipment. Heretofore the promise of growth has been the chief incentive for effort. The obstacles which tax laws now place in their way virtually require that for the present all expansion plans of small companies be held in abeyance, deferring the hope of more jobs.

An apt illustration is the case of a nationally known though not very large machinery manufacturing plant, whose president writes concerning his own experience:

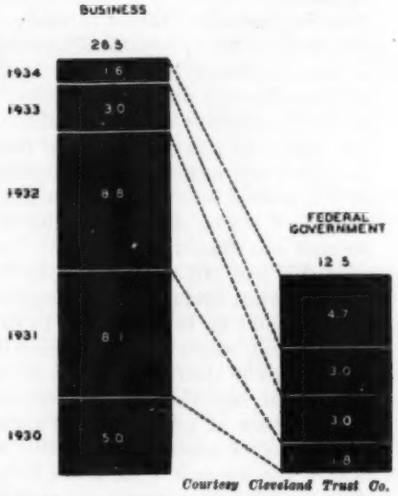
"This company was started with very little capital in 1894. Earnings have been reinvested for years and dividends have been very conservative. We have weathered all depressions up to the present but should another business recession as severe as the last occur within the next five years, the sheriff would no doubt take over our business.

"Our output is heavy machinery. We have capital stock outstanding amounting to $600,000 in the hands of about twenty stockholders. Our plant and equipment show an investment of about $1,000,000, all of which is the accumulation of forty years of reinvestment of earnings. At the end of the year 1929 our surplus amounted to $772,990, of which $315,000 was in cash and Government bonds.

"At the end of 1934 our surplus had dropped to $231,466, a loss of $541,524, and our cash and Government bonds had been reduced to $11,032. During these five years no dividends were paid, yet we increased our engineering force and kept as many men on the payroll as was possible, building machinery for inventory, some of which is now obsolete. Our shop men had one cut of 10 per cent during this period. The office did not fare so well, all officers and office force taking a 40 per cent cut.

"The nature of our business is such that it requires extremely large equipment in the way of machine tools for economical production, and after a prosperous year in 1935, the directors decided that we should replace some rather old machine tools with modern high production units. It was agreed we should spend about $100,000 for this purpose.

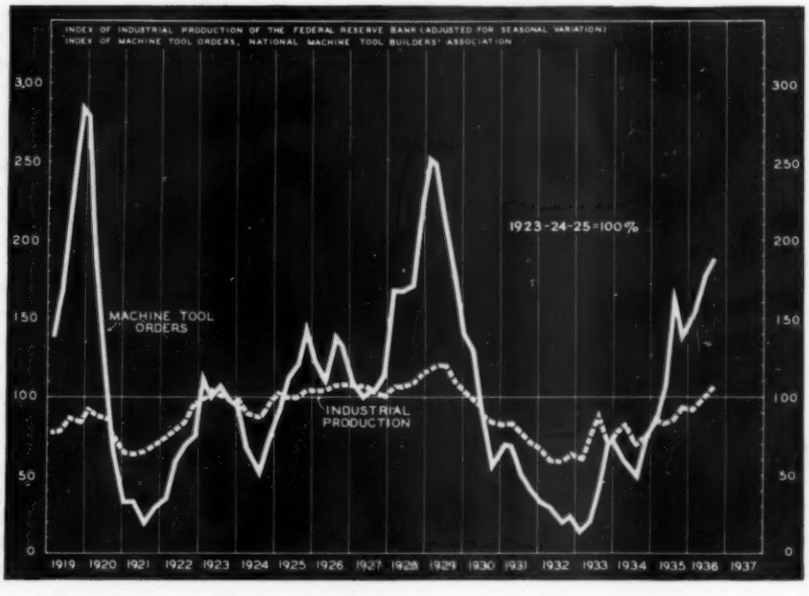
"Orders were placed for two machines the first part of 1936, totaling $38,000, but as soon as the tax on surpluses was proposed our replacement program was canceled and no more new



Courtesy Cleveland Trust Co.

CHART I—*Billions spent for recovery by government and by business. The figures represent payments in excess of receipts*

CHART II—*How demand for capital goods, such as machine tools, fluctuates as compared with industrial production*


INDEX OF INDUSTRIAL PRODUCTION OF THE FEDERAL RESERVE BANK (ADJUSTED FOR SEASONAL VARIATION)
INDEX OF MACHINE TOOL ORDERS, NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION
300
250
200
150
100
50
0
1923-24-25=100%
MACHINE TOOL ORDERS
INDUSTRIAL PRODUCTION
1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937

machine tools are to be purchased. It can readily be seen that should we spend the above amount for replacements and earn $120,000, our new machine tools would cost us 27 per cent more than the price paid to the manufacturer, accounted for by the 27 per cent tax which would have to be paid to the government on the amount we would have to transfer to surplus to replenish our reserves. How we are going to rebuild our surplus to a point where we can weather the next depression is something else for us to worry over.

"We have noticed since this bill became a law that we have received no orders from the smaller companies, orders having been placed only by exceedingly large manufacturers who are backed by huge surpluses.

Incentive to Modernize

"Had the provisions taxing the amount placed in surplus been amended to exempt funds used to purchase new machinery or replacements, the bill would have acted as an incentive to revamp old plants and bring them up-to-date, thereby extending employment to more men.

"It is the opinion of this writer that this bill will in the long run act as a deterrent to the increase in employment.

"Here is another angle. Since our company was organized our labor turnover has been very small. No man has ever been laid off on account of age. Group insurance carried on all the employees is paid for entirely by the company and our wages have always been higher than those prevailing in this district. All employees are entitled to vacations with pay, and in prosperous years receive a bonus.

"During prosperous times it has been the policy of this company to build and carry in stock a certain number of each size machine of our particular product, in order to facilitate quick deliveries. When a machine is not taken from stock, it requires from three to six months to complete it. The value of these stock machines naturally has to be carried in our surplus account. Under the new tax law this policy of carrying stock will have to be abandoned as the tax on machinery in process for stock carried over the first of the year would be taxed more than the profit derived from same. This can readily be understood when it is explained that machines of our make are valued from $10,000 to $60,000 each."

There are hundreds of such cases varying only in details, which emphasize the usual course of development: a business grown from a small beginning to a strong financial position; the constant renewal of equipment to improve the product; the use of cash reserves during depressions to keep men employed on development of new products and building of inventories; the rebuilding of those cash reserves after every contingency. These companies, faced with the prospect of no chance to recover losses, will be forced to curtail every possible bit of employment and expense with the coming of the first business cloud.

This is essentially a problem in the durable goods and particularly the machinery industries. The key workmen in plants of this type are artisans skilled as the result of years of training and experience. It is essential that these key men be retained in times of depression as far as possible financially, so that machinery builders may be in position to render prompt service on repairs to equipment and installation of new machines and processes for their customers the moment times improve. It is a serious loss if these men must be laid off during dull periods, for experience has shown they quickly lose their skill and ofttimes are lost to the industry when again needed. Reserves must be built up in good years to pay salaries and wages of these specially skilled men if their services are to be retained in bad times in anticipation of the return of production. Further large sums of money are required to finance the research work which keeps these men busy when business is dull, and other large sums of money are required to finance new business when it comes.

Reserves For Employment

During the last depression the cash reserves previously stored up provided continued employment for many men skilled in engineering, design and machine operation. A statement made early this year by Secretary Roper of the Department of Commerce called attention to the fact that American industries had expended about 26.6 billion dollars more than their income during the depression. Col. Leonard P. Ayres of the Cleveland Trust Company interprets this as equivalent to a contribution made by industry to overcome the hardships of the depression. Regarding the over-expenditures of the government in a like manner, the government during the same period appropriated, in excess of income, 12.5 billions. (See Chart I.) Think for a moment what would have happened had not industry been able to cooperate with the government to keep things going as best they could. Many small communities derive their principal support from industries of the heavy or durable goods type, which were the hardest hit during the depression. In keeping up their payments of taxes alone these industries were life savers for such communities during the depression. Had the communities been unable to collect these taxes, essential municipal services would have had to be curtailed and the added burden of unemployment correspondingly increased.

There is a sharp distinction between the reserve requirements of the durable goods industries and the consumer goods industries for which the tax laws never have made provision, and do not now. In the consumer goods industries the volumes of sales and profits are maintained at a fairly even rate year after year, the principal variations being the seasonal fluctuations that occur during the year. One year's operation is a complete cycle in which bad months or quarters are offset by good months or quarters. Each year is able to stand on its own. Their cash reserve requirements therefore are reasonably uniform. In such industries taxes on yearly profits are probably as fair a basis as any.

Taxing by Cycles

A comparable fair tax basis for the heavy or durable goods industries would require that a complete durable goods cycle be taken into consideration; a cycle which covers many years, so that just as bad months and quarters of the consumer goods industries are evened off by the good within one year, so bad years in the heavy industries may be evened off by good years within one cycle. (See Chart II.)

Under no past method of taxing earnings has this disparity been taken into consideration, but the durable goods industries have accepted the situation without protest and have done their best to provide reserves to meet their tax burdens in depression years. Now, however, they are asked to carry on under a plan that challenges their very existence, should another depression last as long as the previous one.

Many suggestions are being made whereby a corporation may hold its taxes to a minimum and still conserve cash: that earnings be paid out in dividends and that stockholders reinvest them in the business; that dividends be paid in notes, debentures, preferred stock, thereby postponing cash payments; that additional stock be sold to provide funds for expansion; or that money be borrowed from banks on the best basis possible. In the last analysis these plans are simply not good busi-

ness for most of the people considering them. In some cases there is a question of legality; in many cases grave questions arise as to the ability to carry through the plan without eventual loss to stockholders. Particularly is the latter true if "get around" policies are pyramided year after year in periods of good earnings. There must be a payoff some time, and likely as not it will come and carry with it curtailment of employment when the country can least afford it—in the next depression.

This angle of the problem of policy determination is not the only headache for many managements right now. All sorts of disturbing conflicts add to their worries. The complexity of the bill is opening misunderstanding between those who collect taxes and those who pay them; between stockholders of large incomes and those of small incomes; between stockholders engaged in management and those who are purely investors; between large stockholders and small stockholders. In the larger industries, there is conflict of opinion between comptrollers and factory managements as to whether it is best to conserve cash or invest in means to improve product and processes. In every case management must guess what the year's actual profits are going to be, based on operations for three quarters of the year, because dividends must be paid before the end of the year in order to get tax credit for them.

There is no quarrel with the twofold purpose back of the Revenue Act: first, to increase federal income; second, to prevent unjust tax avoidance. Fair minded men agree on both the necessity of raising money and the desirability of finding some method to force payment of those taxes which have been unfairly avoided by some while others have been paying their fair share. The method pursued, however, bids fair to prove too costly for the common good.

During the hearings before the Senate Finance Committee Mr. George May of Price-Waterhouse Company [1] estimated that income from taxes arising from increased business during the remainder of 1936 would exceed the Treasury's estimate by some 500 million dollars. He gave it as his opinion based on his calculation that it was reasonable to expect the increased business would take care of the additional tax income needed this year. Business has increased beyond Mr. May's best anticipations, and a restudy might show that the additional needed tax income would have been accomplished without any change in the law.

On the second point, the Revenue Act of 1934 carries a provision to prevent the improper accumulation of surplus by exacting an additional tax of 25 per cent to 35 per cent of adjusted net income where it can be shown that dividend distributions are withheld in order to avoid surtaxes. To gage improper accumulation the act specifies:

"The fact that . . . the gains or profits are permitted to accumulate beyond the reasonable needs of the business, shall be prima facie evidence of a purpose to avoid surtax."

While the government has not won its test cases on this section of the old act, it is undoubtedly a fact that the threat contained in that clause has led taxpayers to avoid flagrant violations of the intent of this provision.

When the President impressed upon Congress the necessity of raising additional revenue he suggested the idea of taxing heavily undistributed earnings as one way of increasing federal income. His original message was insistent on the increase but not the method. If a new study of the increase in taxes resulting from the increase in business reveals that the straight percentage tax with which business and the government both are familiar would bring in approximately the extra revenue, it would certainly be a boon to business and to the remaining unemployed if the present tax law were repealed and the old plan retained, perhaps at a slightly higher rate. This would give time for a forthright study of all the various proposals to lessen impact on widely varying types of industries and to study further ways of limiting tax avoidance through maintenance of reasonable reserves.

This is not the first time that a tax bill passed in the face of a definite situation has been found wanting. Mr. H. A. Silverman, Head of the Department of Adult Education, University College, and Director of Vaughan College, Leicester, England, has this to say in his book, "Taxation, Its Incidence and Effects," published in 1931:

"Occasionally, when a tax has been realized to have uneconomic consequences, it has been frankly repealed on that ground. For example, the corporation profits duty was abolished because it was recognized by all parties to have undesirable effects. . . . . This discrimination, apart from the inequity, tended to discourage the investment of capital in those undertakings that contained an element of risk, and to divert it into those channels that provided the greatest safety. The taking of risks, however, is, up to a point, a necessary feature of our economic system, and the penalty imposed on it by the corporation profits duty was, in the opinion of most authorities, detrimental to industrial and commercial enterprise."

It would seem well to take this page from the book of a profound student of taxes who has been able to look in retrospect at a problem similar to that facing American industry today.

[1] Hearings before the Committee on Finance, U. S. Senate, on H.R. 12395, Apr. 30 to May 12, 1936.

Practical Steps in Tool Design

C. W. HINMAN

A new series of articles on practical tool design will start shortly. Jigs, fixtures and cutter-holding devices will be described in the light of the basic principles underlying the functions they are called upon to perform. The articles will be illustrated with specific examples tested in practice.

C. W. Hinman, the author, was educated in the State University of Iowa and the Armour Institute of Technology. At present he is tool engineer for the Kobzy Tool and Electric Manufacturing Company in Chicago. His past experience includes tool engineering for such firms as the Western Electric Company, the Wahl Adding Machine Company, the Automatic Electric Company and the Addressograph Company. Mr. Hinman is already familiar to readers from his past contributions.

Machining the Joint in a Two-Part Bed

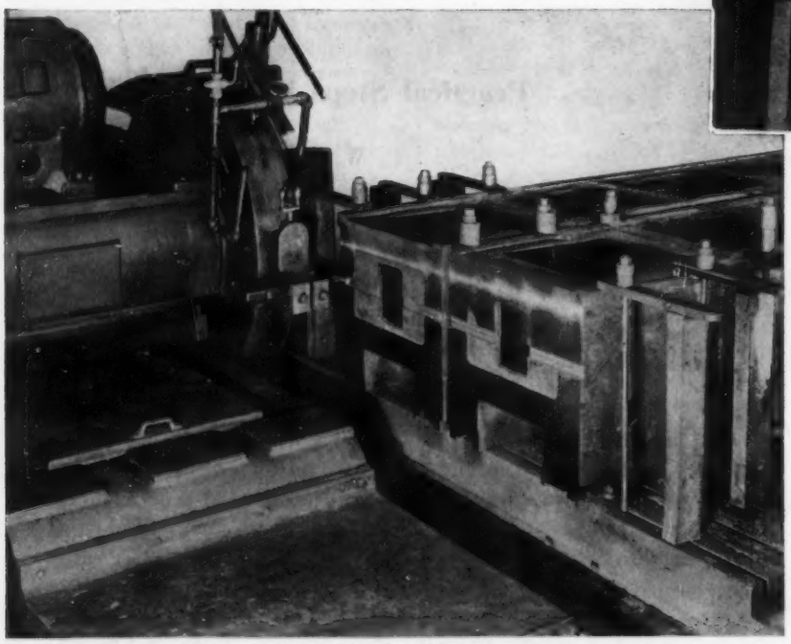
E. B. GARDNER
Hanchett Manufacturing Company

WE MAKE various sizes of face grinders, some of which have very long beds. In one case the bed is 34 ft. long over-all and must be made in two lengths, joining at the middle. Each casting was about 17 ft. long, approximately 24 in. square, and weighed 8,500 lb. Obviously, in making this joint it was necessary to finish the abutting ends very carefully and to provide a keyway in each end.

Instead of machining the ends on an openside planer with auxiliary track for supporting the overhanging ends of the castings, we placed both castings side by side on one of our large traveling-wheel type of grinders. With this machine the work table remains stationary and the wheelhead carriage reciprocates back and forth across the work. The large castings were simply bolted down to the large grinder bed at one end and supported at the outer end by blocking up from the floor.

The area to be ground on the ends of each casting is 325 sq.in. or a total of 650 sq.in. The amount of stock to be removed amounted to as much as ⅜ in. in some places and was quite excessive. The actual grinding time for these surfaces are 3½ hr. complete.

With the same setting the 1½x3-in. keyway was cut. We rigged up a toolholder on the heavy cast-iron wheel guard and planed the keyway in the usual manner. The grinding wheel itself has infeed, and our tool holder mounting was provided with vertical feed, enabling us to get the necessary width and depth.



Two sections of a long grinder bed were bolted side by side on a stationary table and a reciprocating-carriage face grinder was used to finish the adjoining surfaces. Note the toolholder for cutting the keyway

It should be pointed out that both these castings were planed on the bottom and finish planed in the vee and flat ways, which are shown resting on the work table. After the joint was completed and the two pieces bolted together with the keyway, an inspection of the joint in the vee and flat ways showed that they were out of perfect just 0.001 in. which was readily corrected in the scraping. The total time for setting up this entire job, grinding the ends, and planing the keyway, was 5½ hr.

Storing Templets for Torch Cutting

FRED H. COLVIN

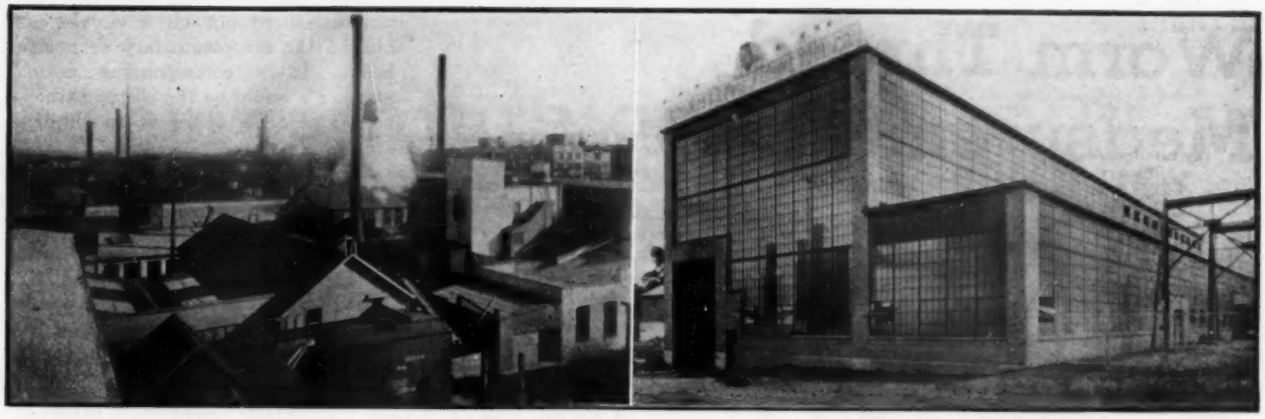
In addition to the interesting operations of torch cutting shown by superintendent James Grant (*AM*—Vol. 80, page 158) his shop has a convenient way of storing the templets used for the wide variety of work it now handles. A rack is built of structural steel, convenient to the cutting table.

When not in use the templets are hung on the rack by hooks welded along one edge

This rack has two angles, as can be seen in the illustration.

The templets are made by welding strip steel of suitable section to flat sheets of a size selected for their convenience in handling. Each sheet or plate, has hooks welded on one edge, these hooks fitting into holes drilled, or punched, in the angles.

The illustration also shows how several forms may be combined on a single plate. On the other hand, parts of the desired outline can be used when the complete piece is too big for one of these plates. The connecting rod ends shown at the right, are examples of this. As the portions of the rod not covered by the templets are straight lines, it is easy to secure the necessary movement of the cutting torch by the regular straight-line guide on the machine itself.



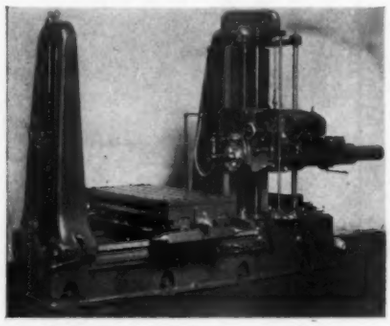
75 Years of Metal Working

Dating back to Civil War days, Giddings & Lewis continues its service to industry as a builder of horizontal boring, drilling and milling machines

FOR three-quarters of a century the Giddings & Lewis Machine Tool Company and its predecessors have had their roots deep in the industrial development of the Middle West. Some 75 years ago the region about Fond du Lac, Wisconsin, was a great timbering area, and the industrial era was just coming into being. Numerous saw mills were operating full blast and offered a fine market for castings and machinery. To seize this opportunity Colonel De Groat, a Belgian, established the first foundry in the state and began to produce castings shortly before 1862. When the Civil War broke out the DeGroat Foundry Company secured a number of contracts from the government for the Union Army.

By the fall of 1862 Mr. DeGroat added a small machine shop, and after the war ended he began to build saw-mill machinery. In addition, a large jobbing business grew up after the railroad was put through in 1872. Colonel DeGroat took his son-in-law, a Mr. Giddings, into the business in 1878, and the manufacture of saw-mill machinery was continued until about 1902.

At this time two occurences radically changed the course of the company. Mr. DeGroat died, and Mr. Giddings took his own son-in-law, Mr. Lewis, into the company, the firm name being changed to the Giddings & Lewis Manufacturing Company. By this time the saw mills had moved west because of the diminishing supplies of timber. Fortunately, an exceptionally good offer was obtained for the machinery line from the Chalmers Company of Milwaukee, and the Murray Iron Works of Wausau. In place of saw-mill machinery, the manufacture of machine tools was begun.



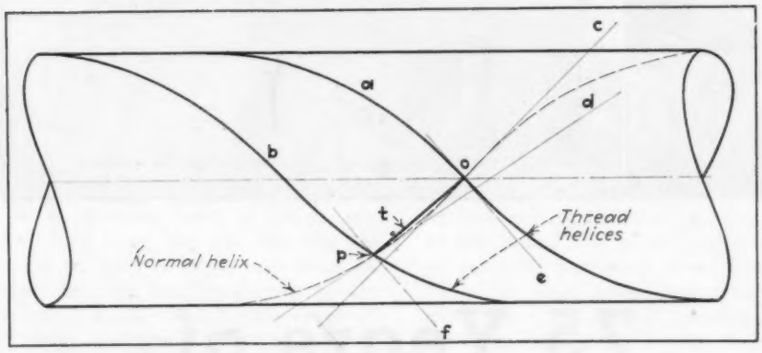
Engine lathes in 17- and 19-in. sizes were built for a period of eight or nine years, until the concern was approached by the Fawcus Gear Company of Pittsburgh to take up manufacture of its gear cutting machines and other equipment for production of Wust-type herringbone gears.

About the same time the controlling interest of Giddings & Lewis Manufacturing Company was acquired by the Rueping family of Fond du Lac, operators of a large tannery. F. J. Rueping entered into a contract with C. M. Conradson who was to produce a six-spindle automatic vertical turret lathe. Fourteen of the larger sizes were built during 1911 and 1912. In these years Mr. Conradson also developed what is said to be the first hydraulic shaper. This machine was never put on the market because of the long-drawn out experimental work involved, but six machines were built. When the World War broke out in 1914, Mr. Conradson moved to Eau Claire, Wis., and the company took large contracts for shell lathes from the British.

In 1915 the last of the shell lathes was completed, and the company found itself without a specific line to manufacture. It then acquired the line of horizontal boring, drilling and milling machines built by the Fosdick Machine Tool Company of Cincinnati, and for the duration of the war built the No. O size.

In 1919 the company was reorganized under its present name, the Giddings & Lewis Machine Tool Company, and has been busy ever since in developing the horizontal boring, drilling and milling machine in various types and sizes. Business had increased to such an extent that, immediately before the depression, the company was required to add a modern assembly building, a power house, and to revamp other parts of the plant. 1936 finds G. & L. enjoying the biggest year's business in its history.

Worm Thread Measurement—Discussion



A vernier tooth caliper applied to the shortest line t *between the opposite pitch helicoids cannot lie squarely on both because* t *is not their common normal*

FRANCIS W. SHAW
Broadley, Whitworth, Lancashire, England

While the formulas of T. R. Rideout (*AM*—Vol. 79, page 861) are close enough for small worms, they will fail if applied to worms of large pitch and large helix angle.

The statement that the formulas have proved exact in laboratory experiments is not understood, for experience has demonstrated the necessity for allowance on the so-called normal chordal thickness, the allowance varying with the helix angle as well as with the pitch.

The formulas given certainly do enable the length t in the accompanying diagram to be ascertained with precision, but that this line indicates the normal chordal thickness is not true. The fact is, the opposite helices have different normals, normals which do not lie in the same plane because they do not intersect. A little study will reveal that t must be inclined to both the thread normals c and d and that the extremities of the line t cannot have contact with a tooth vernier caliper on account of interference as shown by the normals e and f to the extremities of t. Only a sharp pointed instrument could have contact with the helices a and b at the points o and p. A thin gap gage made to the calculated dimensions gives passable results as does also a vernier caliper with its jaws well thinned.

It is, of course, possible to ignore the exact dimension and work to the calculated settings provided that the hobs or fly cutters truly represent the worm as produced. That the thread and space widths should exactly tally is of no import, provided that the worms can always be duplicated.

Attention is drawn to the description of T_N as the normal *circular* thickness of thread; this should be *helical* thickness, for it is the dimension measured not on a circular arc but on the complementary or normal helix. In a corresponding normal plane, T_N would be the *elliptical* thickness, and t the chord of an elliptical arc.

C. A. JOHNSON

The same results can be obtained with less labor by using these formulas:

EPR = Equivalent pitch radius (the radius of curvature of the pitch surface in a plane normal to the thread helix)

T_A = Axial thickness of thread

T_N = Normal circular thickness of thread

R = Pitch radius of worm

λ = Lead angle of worm

$$EPR = \frac{R}{\sin^2\lambda}$$

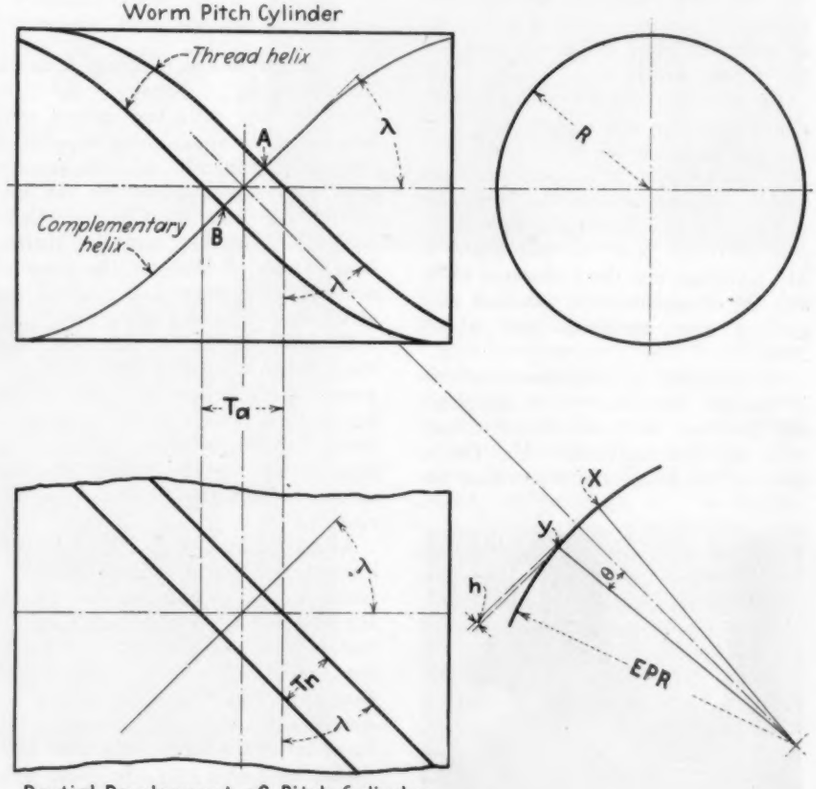
$$T_N = T_A \cos \lambda$$

$$\theta = \frac{T_N}{EPR} \times 28.64789$$

Normal chordal thickness $= 2 \times EPR \sin \theta$

$$h = EPR\ (1 - \cos \theta)$$

Corrected addendum = Addendum + h



Mr. Johnson's method illustrated

Temperature and the Galvanizing Furnace

For maximum pot life temperature must be held below 870 F.

WALLACE G. IMHOFF
President, Wallace G. Imhoff Company

ONE of the most difficult industrial heating problems is the design and construction of satisfactory hot-dip galvanizing furnaces. If the combustion of the fuel were the only factor to be considered, the problem would have been solved long ago. However some of the best designs, from the standpoint of fuel economy and efficiency, have had a pot failure only a short time after the furnace has been put into production. It is obvious, therefore, that the design and construction of a satisfactory hot-dip galvanizing furnace requires a whole lot more knowledge than how to burn the fuel efficiently.

For this reason, a careful determination has been made of the point at which the destructive action of molten zinc becomes violent. The graph shown in Fig. 1 is the result of this investigation. As indicated in this graph, temperatures up to 870 F. produce a moderate dissolving action of the molten zinc upon iron. From 870 to 900 F. the dissolving action goes on slightly faster, although not dangerous nor violent. Above 900 F. the curve changes abruptly and goes almost straight up. The iron is dissolved faster and faster as the temperature rises higher and higher. Complete destruction of the pot now becomes only a matter of wall thickness and time.

Knowing this, it is easy to understand why so many galvanizing pots have failed quickly, even when fuel combustion has been ideal. This means that the total volume of heat supplied for galvanizing, no matter what the production, must be at a temperature under 900 F.

This practical condition of heating is clearly illustrated in Fig. 2 and Fig. 3, the first showing correct heating conditions; the second showing conditions often found in practice. From the standpoint of pot life, conditions as indicated in Fig. 2 will tend to give the best results.

Submission of the three charts does not tell the whole story. Further explanation is necessary to indicate the real importance of temperature regulation.

The vital factor that affects the bath temperature is the production put through the bath. This statement must be qualified in a given manner, such as: pounds per hour or pounds per load. It has not been so long ago that whole bundles of pipe were dropped into the galvanizing bath at one time. It was not uncommon for the bath temperature to register a drop of ten to twenty degrees when this was done. This necessitated carrying a high bath temperature and produced an irregular temperature curve. Both of these factors favored early destruction of the pot.

Fig. 2 shows the proper way a hot-dip galvanizing pot should be operated. The bath temperature should be low and should be held at an almost level point. Every kind of work and all productions can be galvanized at bath temperatures between 840 and

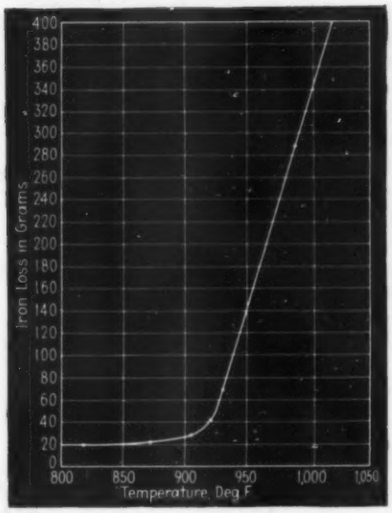


Fig. 1—The corrosion rate of galvanizing pots increases rapidly when temperature is raised above 900 F.

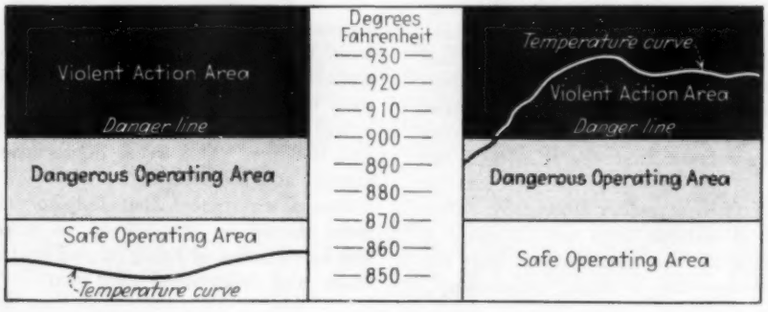


Fig. 2—Sample of temperature chart for a properly operated furnace

Fig. 3—Temperature charts such as this indicate rapid pot deterioration

870 F., if the furnace is properly designed.

The problem, then, is to design the furnace so that it will take the desired production and hold the temperature within these limits. This design should never permit temperatures above the 900 F. danger point, either in the bath or at any point in the pot. Pots can be destroyed prematurely, even though the bath temperature be well below the danger line, if the heat is not evenly distributed.

There is a by-product formed in hot-dip galvanizing called "dross". This material will average, in general, about 96 per cent zinc and about 4 per cent iron. Dross is slightly heavier than zinc and will, therefore, settle to the bottom of the pot. It has the peculiar property of drying as it is heated —the more heat, the dryer it becomes. Also, as it becomes more dry it absorbs additional heat, producing an endless cycle in the bottom of the pot. The race of destruction is on; as the temperature rises above 900 F. the life of the pot is further shortened.

This, therefore, brings into play another design feature that must be applied to galvanizing furnaces. Heating must be done above the dross line. Temperatures of 840 F. have been found at the top of the bath, while in the same vertical plane down in the dross the temperature was 1,350 F. It is needless to say that both the time-life and pound-life of these pots were short. The temperature in the dross should not be permitted to rise above 875 F. at any time.

The whole problem of hot-dip galvanizing furnace design resolves itself, therefore, into constructing a furnace that will first, supply enough heat for the desired production; second, supply the heat in such a manner as never to raise the galvanizing bath temperature above 900 F. at either the top or the bottom of the pot; third, apply the heat above the dross line; fourth, apply the heat in such a manner that there will be no hot spots; fifth, have sufficient heat reserve to take care of production without a loss of bath temperature and without producing surges of bath temperature considerably above 900 F.; sixth, maintain the temperature curve in as nearly a straight line as possible at all times; and seventh, be arranged to give perfect fuel combustion.

All this is a big order for just one furnace, so it is no wonder that at present the last word has not been said in furnace design. The past fifteen years have shown remarkable advances, but the problem is still far from being solved satisfactorily. When it is considered that there are four or five fuels used and many different fields of galvanizing with varying productions of different parts, it is no wonder that progress has been slow.

Other factors which affect furnace and pot design are the production desired per hour, the sizes and shapes of the parts to be galvanized, the heat storage capacity required and the bracing and auxiliary equipment.

In considering pot life, attention must be given to the amount of production passed through it during its useful life. The only correct way to state the life of a galvanizing furnace is by the pound-life of the pot, the actual pounds of material put through the pot from the time of installation until the pot is replaced because of failure. Life measured only in time is inaccurate and misleading because the pot may be shut down for a period of time and started up again later.

More Holes Per Tap

WILLIAM KAUFMANN

I ONCE asked a nut manufacturer why he did not use ground-thread taps. He said: "They do not hold size. Come with me and see for yourself." An operator was instructed to put a ground-thread tap in the machine and to tap a few nuts. Then my friend told me to try the "not go" plug gage. It went in all the way, despite the fact that the ground tap was 0.001 in. smaller in pitch diameter than the rough-cut tap in daily use.

When I suggested that his rough-cut taps were undoubtedly very long or short in lead, he burst out: "What do I care. I'm making Class 3 nuts, the Class 3 "go" plug enters, while the "not go" plug enters about two turns, which is acceptable for a Class 3 fit." He went on to say that his customer checks the nuts in the same way and of course accepts them. Moreover, he claimed that since the diameter of the ground-thread tap is smaller than the rough-cut variety, more wear was secured from the latter. His contention was that the ground-thread taps did not hold size and cost more.

Now here was a nut manufacturer and his customer who were not worrying about lead error. The customer accepted the nuts without questioning because they met the usual test. How did he know if he was getting nuts with only two or three threads doing the work? And wouldn't he be sore if he learned that the nuts were tapped way oversize in pitch diameter to overcome lead error, and therefore, that he was getting an inferior product?

Many ideas have been advanced for testing tapped holes and taps. For a thorough job a well-equipped inspection room is necessary and will be very expensive to set up and maintain. However, we know that ground taps range from the skin ground, or polished rough-cut, variety to precision ground taps. Certain ground-thread taps do not require checking, because inspection records are furnished by the manufacturer or can be secured from him. By paying a little more for this class of tap, money can be saved by eliminating inspection entirely. Of course, it is good practice to let the tap manufacturer know that one is critical and that a few taps may be sent out on occasion to a testing laboratory. Records of outside tests are of value in proving to the management that tap inspection can be made unnecessary.

Of course, commercial ground thread taps from different manufacturers will vary considerably. In checking the performance of several makes I found that all came within the limits for a Class 3 fit, and that they cut within those limits, but the product of one maker gave much more life than the others. I looked into the reason for this and found that he was making taps consistently to the high limit. Of course, the entire limit is available to the tap maker, but when he keeps his product up close to the high limit, it means almost 20 per cent more holes per tap on the average for the user.

Not Charged to Inventory

Some concerns do not carry small tools that wear out rapidly, such as portable electric and air drills, on the shop inventory as machine equipment but as supplies, the same as twist drills and the like. This saves depreciation charges and bookkeeping.

Special equipment that fails to perform should be charged up to profit and loss instead of being carried on the books and depreciated each year.

How to Grind to Half a Tenth

Many attributes are needed for accuracy, including an eye for sparks and an understanding of the law of gravity

CHARLES WESLOW

I WAS GIVEN the job of grinding 1,250 stop plates to within 0.00005 in. They were made of B. & S. ground tool steel as per dimensions in sketch.

The tolerance on the thickness and width was plus 0 and minus 0.010. Dimension *A* was obtained from a chart, and each plate was stamped a symbol numeral to match the symbol on the chart. Dimension *A* varied from 0.875 to 1.375 in.; some of the plates varied only 0.0005 in. Others varied 0.005 in.

The plates were cut off on a milling machine, allowing 0.010 in. for grinding. They were hardened and ground only for dimensions *A* on both ends; no lapping but ground smooth. I found it most desirable to make a fixture to hold them while grinding and designed one as light as possible, arranged to mike the plate without removing it from the fixture. Every time the fixture was removed from the magnetic chuck for measuring, it was replaced on the same poles of the chuck and on the same spot, because one cannot replace a job requiring accuracy on some other part of such a crude instrument as a magnetic chuck unless he is positive that the chuck is absolutely flat and parallel with the slide of the machine. Such a condition is rare when it comes to grinding to close limits.

Fixture Made Light

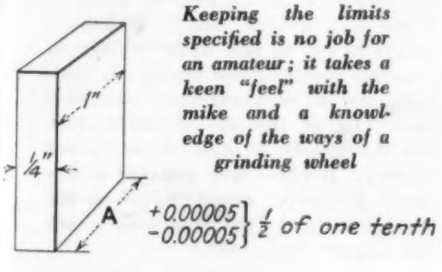
My employer is an old timer like myself, but it took a "practical" old timer to show him that gravity is an evil influence when measuring such a thing as these plates while being held in a steel fixture, which had to be large enough so as to make measuring practical and have body enough to become attracted to a magnetic chuck.

A plate, shown in the sketch of the fixture, is held in position with screws *1* and *2*. Dimension *A* had to be large enough so that the emery wheel would cross all the way over the plate. The sketch is approximate. Dimension *B* is $\frac{1}{16}$ in. more than the longest plate to be ground. *C* is the distance between the poles on the magnetic chuck, so that the legs of the fixture would not rest on any of the lead insulation of the chuck. *D* is 1¼ in. considering that it should take in enough area on the chuck so as to eliminate any possible chance of tilting.

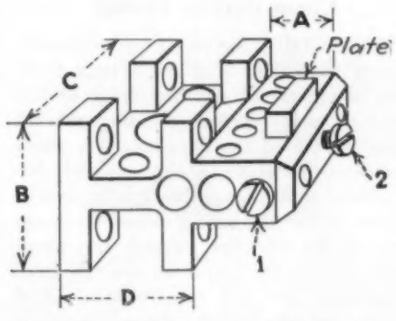
Note how the fixture was lightened as much as possible and drilled full of holes just for that reason, but even so, the weight of it became an evil influence in measuring. I first ground a dummy plate to a specified size, but found that I would have to grind all plates over 1 in. 0.00015 in. undersize when still in the fixture, and 0.0001 in. undersize on plates under 1 in. in length. I showed my first dummy plate that I ground 1.37485, to the boss for him to measure, saying that it was 1.375. With a magnifying glass on his eye, he measured and measured when finally he said it was 0.00015 in. under 1.375 in. I removed it from the fixture, and gave it back to him to measure again, and said he, "Who'd ever think of that?" Said I promptly, "Only an old timer like me. I'm sending the fixture and my 2-in. mike to the editor of the *American Machinist* to find out if he can measure to within 0.00005 in. and check up on the necessity of grinding 0.00015 in. undersize while measuring a plate that is held in the fixture."

If you don't know what I mean by the evils of gravity, then hold a one pound steel ball in one hand and a pound box of your best girl's candy in the other, then decide for yourself which is the heaviest.

For those who are interested in knowing how to grind to within 0.00005 in., smooth finish, the following should suffice. In the case of these plates, soon as I started in to grind, I told the boss I would quit the job if anyone came to me to talk, or if anyone started whistling any tunes from Sweet Adeline to Eddie Cantor's latest feature. It was absolute quiet for me all day long or else it was a free seat for me in the park. And that goes for those young fellows who think they can talk and work at the same time, not mentioning anything about those who carry on a whistling concert all day long.



Keeping the limits specified is no job for an amateur; it takes a keen "feel" with the mike and a knowledge of the ways of a grinding wheel



The reversible fixture for holding the work was drilled full of holes to keep down its weight

Before replacing such a fixture back onto the magnetic chuck, always clean that particular spot on the chuck with a piece of fine emery cloth. Don't use a brush, rag or cotton waste; after cleaning with the fine emery cloth, wipe it off with your fingers.

Such precaution on accurate work is just as important as when using Johansson blocks. No one would think of hitching up two Johansson blocks unless they were clean, and even so they cannot be just thrown together. They must each start sliding together

from the outer edges, so that any minor dust will be shoved off each block. And so with the grinding fixture described herewith. Were it a question of merely 0.0005 in. tolerance, then it would be different. But this job calls for a tolerance of one twentieth of one thousandth, or one tenth of a half thousandth, whichever way you care to comprehend it.

The first move regarding this particular job is to dress the emery wheel with a sharp diamond. Not a diamond that is worn to the shape of a miniature steel ball. Then re-dress the wheel with a piece of carborundum held secure in a parallel clamp which causes the wheel to cut smooth. However, all the plates were cleaned by rubbing on a cast iron block that had been charged with carborundum, so as to eliminate the possibility of forcing the emery wheel into oily dirt that adhered to the plates from hardening. Some of the plates got bulged from hardening, but that didn't matter if the two opposite ground ends were parallel, and such a condition was assured because the fixture was accurately made in relation to the feet and the groove in which the plates were held. The magnetic chuck had to be ground off to insure accuracy at that point.

Clean Before Truing

Incidentally, don't ever try to remove more than 0.0005 in. at a time from the magnetic chuck, beginning at the highest point; before grinding rub off the surface of the chuck with a small piece of dry cast iron charged with dry carborundum of medium grade. Never leave it for the emery wheel to scoop up all the oily dirt, because the wheel will get clogged up soon enough from grinding the cast iron chuck. And don't be too lazy to dress the wheel every time it runs across. That goes when you are grinding thin pieces of hardened steel, as well as various other grinding jobs. Lots of boys and men are either too lazy or afraid to dress the wheel often enough—"afraid" they may not be able to get the wheel back to where it left off. If you are afraid of that, then go learn the "trade" of shoemaking, or get a job with the WPA dusting off cobble stones.

We got an apprentice where I now work who is not too lazy, but he hates to get up off the chair that clings to him like his shadow. He can't oil up a countershaft unless he sits atop the stepladder. He's one of those boys who learned what he could in a Newark, N. J. vocational school, and then struck out for a job at 35 cents an hour. They teach the boys how to operate the various tool-making machinery all right, but they don't teach them any manners or courtesy toward others. I happen to be well acquainted with the business manager of Newark, N. J., public schools, and hope he reads this and acts accordingly.

Several years ago I visited a Ford exhibit in New York City where they exhibited, besides innumerable cars, toolroom apprentice boys at work on various machine tools and at benches laying out work with a height gage. What struck me most was the amicable disposition of the boys and their alertness.

Referring again to the plates, 0.010 in. was left on for grinding because in sawing them off in the milling machine the saw could not be depended on to cut them off smooth. After one end of the plate was ground, the fixture was turned over, the emery wheel raised, and then brought down again so as to start a new cut on the opposite fresh end to be ground. Soon as the saw marks were ground out, the fixture was removed, and the plate measured to find out how much more was to come off. It was replaced on the chuck, and then the graduated wheel on the machine that raises or lowers the wheel was depended on to bring the wheel down successively to within 0.001 in. of the required size.

That is when you quit working to within one thousandth. You then start in to comprehend that you are a gage maker, working to within 0.0001 in. And as soon as you have removed another 0.0005 in. according to the graduations on the adjusting wheel, you remove the fixture again to measure again to find out how much more is to come off. But this time when you replace the fixture, keep your hands off the adjusting wheel and run the wheel across, but start gently to make sure any dust didn't happen to get under the feet of the fixture. At that stage, I can tell how much the emery wheel is taking off by the amount of sparks that fly. (But I don't count them.) I had my choice of an emery wheel, and selected a 7-in. vitrified wheel, ½ in. thick, 946 grain.

Because the adjusting wheel is not graduated in tenths, I watch the sparks, although the graduated lines on the wheel help some. When I remove the fixture again for measuring (I sit down to measure), I find it is within two or three tenths to size, and that is when I handle the adjusting wheel the same as I handle my wife's purse strings when she's looking. Before I know it, I am to within one tenth of size. I replace the fixture and leave the adjusting wheel alone, until I feel certain that the emery wheel is not cutting. Then I tap the handle of the adjusting wheel with my clumsy middle finger just enough to see a few sparks fly. Sometimes you are not successful in lowering the wheel enough, but you have to remove the fixture just the same to measure all over again. Then, if it is necessary to replace the fixture again, just to scratch off another half a tenth, you leave the adjusting wheel alone, as you would a hot pancake. I use my middle finger that way, because I long ago trained it for use as a hammer.

Never hook up the automatic feed on the machine when doing accurate surface grinding work because the effect the automatic device has on the oscillating table is the same as if you struck the table a blow with a hammer every time the table reached each end of the stroke; which reminds me of some "toolmakers" who slam something on their bench alongside of you when you are about to scratch a line with a height gage on your surface plate.

Getting the "Feel"

In the process of measuring with a micrometer, when it comes to measuring to within 0.00005 in. the inexperienced should practice up a bit on a Johansson block of suitable thickness, but be sure the mike is a real good one; not one that has seen better days. You should "slide" the mike on the work, starting at the nearest edge of the piece to be measured, and when the anvils of the mike are set firmly against the surfaces of the work, tighten them slightly and slide back and forth very slowly; thus you "feel." Then you must loosen up a bit on the mike so as to measure as near perfect as the makers of the mike intended.

Another vital thing to remember is, whenever you oil up the slides of the machine table you are raising the table that much. If you are fussy in wanting to know how much, then get two Johansson blocks, oil the surfaces and stick them together that way. Then measure the two blocks with the oil in between.

Soon as I see a man or boy hook up the automatic feed on a surface grinder on jobs four inches long or under, I know he's a slow poke. If anyone comes to you to talk while you are on accurate work, shove cotton in your ears, just to let them know it annoys you. Out of the pile of plates given me to grind, I must have spoiled twenty. If I had been annoyed in any way, I surely would have spoiled enough to make the junk man smack his chops.

Talking Shop

What's in a Name?

Naming things isn't as easy as it looks, in spite of the man who said that "anyone would know a hog was a hog to look at it." And names are important if we expect the other fel-

low to know what we mean when we say "clearance", "relief", "rake", or whatever it may be. While we'd all prefer to have the names logical, the main thing is to have them universally understood. But how we cling to old names even when they are of questionable application!

Years ago some bright chap devised an attachment for a lathe that cut away the metal behind the cutting edge of such tools as taps and milling cutters. About half of us called this a "backing-off" attachment while the others felt that "relieving" was a better name. No matter which we call it we have to describe the operations as making a "clearance" back of the cutting edge. So we got into the way of speaking of "clearance" on practically all tools from single point lathe and planer tools to milling cutters.

All tap makers, however, cling to the word "relief" which is also used to some extent on reamers. Tap men are also about the only ones who now consider "land" as the entire portion between the flutes. Land, in such tools as reamers, now generally means the portion directly behind the cutting edge which has not been backed off, relieved or cleared, as you prefer. Drill men now call this the "margin."

One name may be as good as another but we might better agree on some one of them, and stick to it. After all, we don't get far in the operation of any shop unless we all talk the same language.

What Speed Carbide?

If any young engineer gets the idea that all the important advances have been made and there are no more worlds to conquer, he should sit in while a few up-to-date tool men discuss modern turning practice. It's especially interesting when both high speed and carbide men are in the bunch. The listener will soon find that there is still ample room for experiment and additional knowledge.

Because carbide tools will stand high speed we have come to believe—and this idea has been fostered by carbide men themselves—that high speed, light cuts and fine feeds are best. It is just possible that this advice has been partly psychological, and given because other tools cannot stand as high speed. Running a cut at from 200 to 500 ft. per minute is spectacular and tends to make one overlook the small cuts and feeds.

One carbide man, however, works on an entirely different tack. He uses speeds as low as 60 ft. per min. at times on cast iron, and takes cuts from ½ to 1 in. deep with $\frac{1}{16}$ feed or better. In some cases it's an intermittent, or "jump" cut at that. It isn't spectacular but he gets the job done and he keeps his customers sewed up so tight by the economy he gives them, that the high speed boys don't get a look in. He breaks all the old rules but gets results—and orders.

Rubber Fenders

Stretchability and elastic limit get plenty of exercise in some of the new fenders for 1937 cars. When a 92-in.

sheet comes out 10 in. longer than it went in, and when some of this stretching exceeds ¾ in. in a space of 2 in., we have something to think about. If fender designs call for much deeper draws we may have to think of synthetic rubber or some other material.

Lapped Tools

Many an old machinist carried a small oil stone, or slip, in his pocket, or had it handy to his bench or machine. He used to stone, or "touch up" the cutting edge of even carbon tools at times, especially on finishing cuts. Modern tool experts carry this a

step further and advocate lapping the cutting edges, or surfaces, of carbide tools. Some say it helps also on high speed tools.

New abrasive wheels now handle these extremely hard tools in short order. The diamond grinding wheels come in various grades and have greatly reduced both the time and the guess-work in reconditioning carbide tools. And, where size is important, some advocate lapping the tool both on the face and the cutting edges.

A lapped upper surface allows the chips to flow more easily and tends to reduce the "cratering" behind the cutting edge. Where size is important, as in the tools for cutting piston ring-grooves, a tool with the sides lapped will hold its size longer than one that is used just as it comes from the grinding wheel. And this is true even if a fine grain diamond wheel is used. High spots, no matter how small, wear off and leave the tool too narrow.

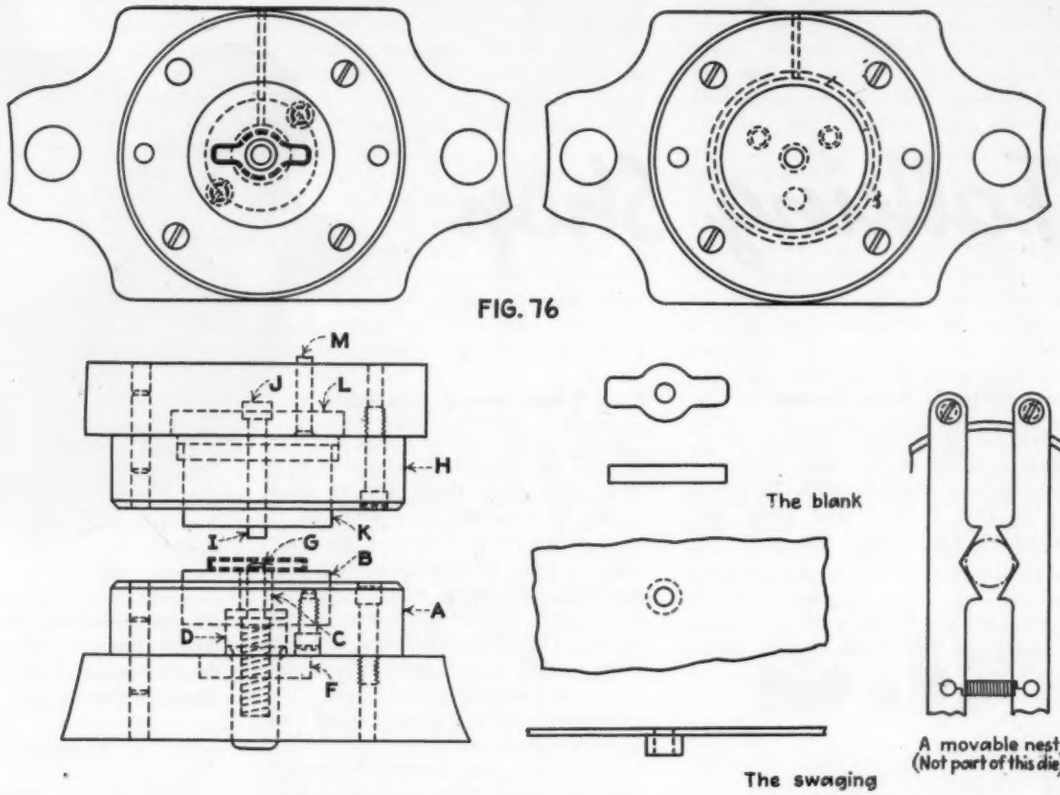


Fig. 76—Sizing pin I enters the hole in the blank first, and then the main punch flattens the part and causes metal to flow down into the die cavity to form the boss. At right is a spring-controlled nest, which has no connection with this die

Die Design and Die Making

A convenient method of flowing metal into odd-shaped parts, swaging can be done in conjunction with other operations

E. G. MARSHALL
Master Mechanic, Charleston Works, The American Fork & Hoe Company

SWAGING is a different method of shaping metal than any previously described in this series. It is really a cold forging operation and, in consequence, great pressure is required to cause the blank to assume the shape in the dies. The procedure is to lay the slug or blank over a depression in the die block, and then apply heavy pressure slowly by means of the upper member. There is always some excess metal that flows out between the dies to form a flash or fin, and this must be trimmed off in the same or a subsequent operation.

Parts can be swaged to all sorts of odd shapes that would be impossible to produce in any other way. The metal used should be dead soft and very ductile. The shape that the part is to assume can be sunk into either the upper or the lower member. In some cases a different shape can be used in each member and the parting line is so placed that the two shapes meet on the piece.

When nest plates are used for swaging dies, they must not be solid, but of the spring-controlled variety. This construction is necessary because the metal swells. With spring-controlled sections, the nest will yield as the metal bulges. If there is a hole in the blank, a spring-locating pin is used in the lower member, and a sizing pin in the upper member enters the hole in the blank and shoves the locating pin out of the way as swaging commences.

A swaging die with a locating pin is illustrated in Fig. 76. In this case a sub-press of a standard variety is chosen, but on dies subjected to heavy tonnage use a forged steel sub-press of ample thickness. Lower die block *A*, which is made from tough water-

hardening tool steel, is screwed and doweled to the lower member. The center is machined out to receive the swaging insert *B*, but enough material is left to act as a back-up. The center is cleared for the lower knockout.

A special grade of tool steel such as employed for cold-forging dies is suitable for the lower die insert *B*. This part is made a light drive fit in the die block and is held in by screws. Dowel pins would be used in addition to the screws where the relation of the upper member to the lower member must be maintained. The desired shape for the swaged portion of the work is machined in the center of the die insert and enough stock is left in the hole to be stoned or ground out after hardening in order to get a good job. The walls of this opening must be very straight and very smooth. The lower end of the hole is machined to clear the heel on the shedder *C*.

The lower shedder is made a snug sliding fit in the insert and the heel prevents the part from being pushed up through the swaging opening. A hole is machined in the center of the shedder for the spring locating pin *G*, and the top is ground in assembly to give the swaging the desired thickness. The shedder bottoms on the knockout *D* and the back-up plate *F*. It is made of tool steel and hardened and ground.

The top of the lower knockout plunger *D* is made to the same size as the heel on the shedder. However, the lower end is turned down to leave a shoulder that fits on the back-up plate *F*, but the bottom end must be big enough to contain the spring for the locating pin *G*. In the up position the bottom end of the plunger should extend $\frac{1}{32}$ in. below the sub-press. Tool steel is required for this part.

The back-up plate *F* is inserted in the lower member of the sub-press and its only function is to back up the thrust of the shedder in swaging. Locating pin *G* is made to suit the low limit of the hole in the part and is a free sliding fit in the shedder. A shoulder on the bottom prevents it from being shoved up through the shedder and a spring under it in the knockout plunger keeps it in position.

Die block *H* on the upper member is made of tough water-hardening tool steel and is screwed and doweled in place. The center is machined to receive the swaging punch and clearance is cut in the back to clear the heel on this punch.

Swaging punch *K* is a snug sliding fit in die block and is made of a special steel for cold forging work. When in the up position, the lower end of the punch extends out of the die block by $\frac{3}{8}$ in. Sizing pin *I* is $\frac{1}{16}$ in. below flush at this time. The travel of the punch should be enough to let the sizing pin pass through the blank and enter the lower die before swaging commences. This pin is made of tool steel, hardened and ground, and is mounted in the plate *L* and backed up by the plug *J*. The point of the pin is the size of the hole in the finished part and is a snug fit in the lower shedder and the upper punch.

Back up plate *L* is made of tool

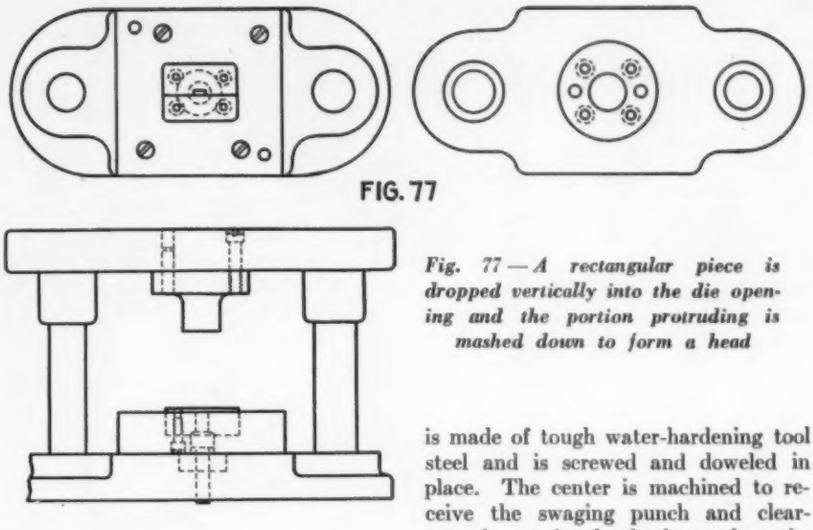


FIG. 77

Fig. 77 — A rectangular piece is dropped vertically into the die opening and the portion protruding is mashed down to form a head

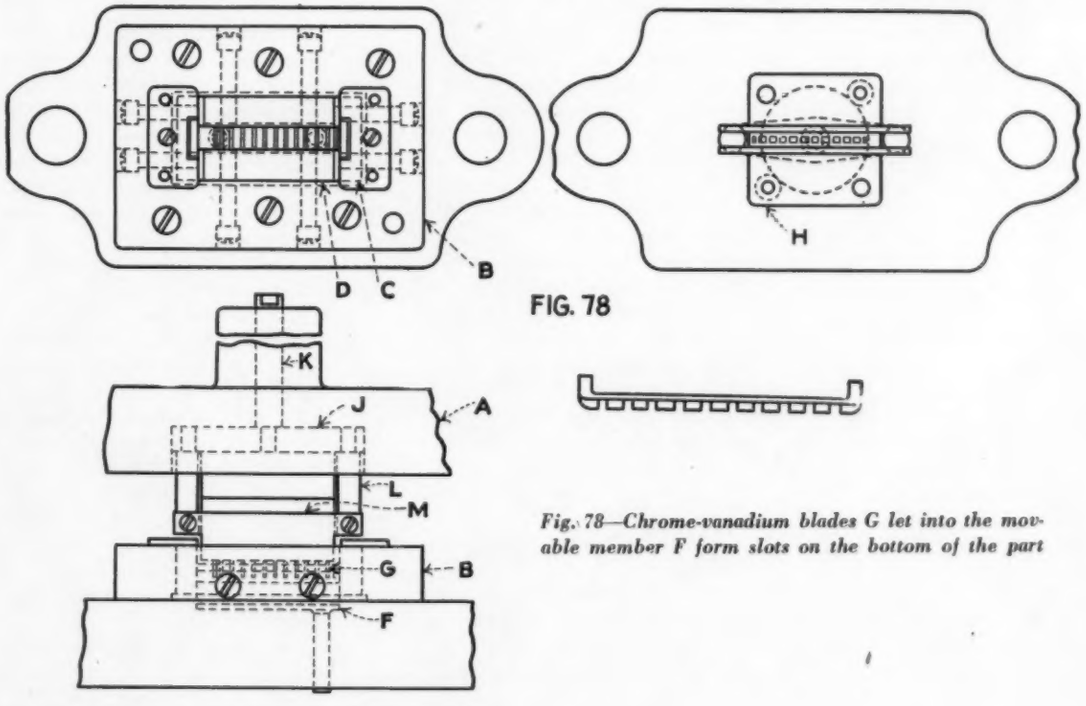


FIG. 78

Fig. 78—Chrome-vanadium blades G let into the movable member F form slots on the bottom of the part

steel and hardened. It is inserted in the upper member and backs up the punch in swaging. Knockout pin *M* operates the punch to eject the part from the sizing pin.

Fig. 76 shows a die in which the blank is laid flat and the die used in a swaging press. Fig. 77 shows one in which the blank is dropped into a slot and the die is used in a regular high-speed press. In this case the top end of the piece is swaged down to a thin flash which is trimmed to size in another die. The swaging insert is made in two pieces so as to be easier to machine and the opening at the top is tapered so that the part is ejected more readily after swaging. An ordinary round punch with the end flat is mounted on the upper member.

Both forming and swaging take place in the die shown in Fig. 78. The part is made of 0.050 in. cold-rolled soft steel. The ends and the side channels are formed up and the slots are swaged. Since the part is symmetrical a note should be stamped on a die of this type to the effect that it should be loaded with the burr up. By so doing the burr will wear the die to a lesser degree than if it faces down.

In common with most of the high-production dies illustrated so far, the tool shown in Fig. 78 makes use of a standard purchased sub-press *A*. Die block *B*, made of tool steel and hardened and ground, is screwed and doweled to the lower member and the center is machined to receive the inserts *C* and *D*. These parts are made from chrome-vanadium tool steel and hardened and ground. They are held in place by fillister head screws and the distance between the inside faces of *C* and *D* is the same as the over-all length of the part. A radius of $\frac{1}{16}$ in. on the inside top corner of the end inserts *C* is provided for the ends of the part to form over. Side inserts *D* form up the sides of the part and are spaced to suit the over-all width.

In the opening between the inserts, there is fitted a movable member *F* which is a snug sliding fit, and has a heel on the bottom. The top is milled to receive the blades *G* which swage the slots in the part. These blades are made of chrome-vanadium steel and are drive fit in the movable member. After assembly a slot is ground along each side and a small tool-steel key is riveted in to prevent the blades from loosening and working out. Holes for the rivets were drilled, of course, while the movable member was soft.

Knockout pins in the lower member transmit the pressure of the spring underneath and return the movable member to the up position to eject the part. These pins are made of tool steel and hardened.

Punch *H* on the upper member is screwed and doweled in place. The lower end is machined to leave humps that swage the inside of the part between the slots. The upper end is made with such a large heel as to cover the slot milled in the upper member for the movement of the knockout bar *J*. This bar is operated by the center post *K*. End posts *L* are screwed into the knockout bar and pass along the ends of the punch. Blades *M* are screwed to the posts and travel along the sides of the punch. These end posts and side blades are all used to eject the part from the punch, and they are made of tool steel and hardened.

This concludes the series on *Die Design and Die Making.*

What Do You Know About Babbitt?

A. EYLES
St. Albans, Hertfordshire, England

I SHOULD like to add a few remarks to the article by A. Hoyt Levy (*AM*—Vol. 80, page 696) regarding babbitt requirements and characteristics.

Experience shows that the principal qualities which a good babbitt should have are: good anti-frictional properties, to withstand heavy loads at high speeds without heating; and sufficient compressive strength so as not to be squeezed out of place under high pressures, or to fracture or crack when subjected to sudden shocks.

In addition to these, there are many other properties which should be considered in choosing babbitt, depending upon the special purpose for which it is to be utilized. For example, temperature variation is often an important factor, especially in modern refrigerating plants. Thus, the co-efficient of expansion must be considered to prevent undue binding, with subsequent failure or destruction of the bearing. Also, thought must be given to possible variations in other properties, such as ductility and brittleness under varied temperature conditions.

The essential characteristics in babbitt for bearings are composition, structure, anti-friction properties, temperature of running, wear on bearing, wear on journal, compressive strength and cost.

Tin-base babbitts are usually harder than lead-base babbitts, though there are exceptions. Tin-base babbitt is preferable for use in bearings that are subjected to a constant light pounding action. When it is used, fracturing and distortion are practically eliminated if the lining is fairly thin and backed up closely by the harder metal which forms the shell of the bearing.

Lead-base babbitts are legion. They are composed of 60 to 90 per cent lead, 7 to 18 per cent antimony, 1 to 10 per cent tin, and a small percentage of copper. The chief characteristics of high lead-base babbitts are a moderate degree of hardness and compressive strength. However, they have low tensile strength. Thus, they tend to elongate and squeeze out. They have good self-lubricating qualities.

Mr. Hoyt said that the common specification that babbitt be made of "prime, virgin metals," is an unnecessary phrase. He failed to add that babbitt made from virgin metals gives off very little dross when properly melted, whereas that made from reclaimed metal invariably gives off a great deal.

Not infrequently, the babbitt is the first to get the blame when a babbitt bearing fails. Experience with all types of babbitted bearings shows that in the majority of cases the fault is not due in any way to the babbitt. There are many reasons for failure and most failures may be traced to one or more of the following causes:

1. The use of the wrong grade of babbitt for the particular service.
2. Pouring at too low a temperature gives rise to the formation of coarsely granular structures, while excessively high temperatures increase the softness of the alloys without correspondingly improving the tenacity. Every babbitt has a "best" pouring temperature, and this correct heat should be ascertained from the manufacturer of the babbitt.
3. The lubricant may be entirely unsuitable.
4. Grit and other foreign matter have caused abrasion and wear.

Editorials

AMERICAN MACHINIST ESTABLISHED 1877
VOLUME 80 NUMBER 27
K. H. CONDIT • F. H. COLVIN
EDITORS

A NEW SPIRIT

THERE is a new spirit abroad in the ranks of business and industry—a spirit of cooperation. It is not a spirit limited only to the Christmas season, but it is a spirit that is particularly appropriate to this season.

President Roosevelt has asked for the cooperation of business in consolidating the advances out of the depression that have been made already, and in planning the moves that will carry us the rest of the way to our goal. The manufacturers of the country, in their meeting earlier this month, have signified their willingness to meet him half way. This cooperative spirit is new. The men whose leadership lined up the manufacturers in favor of it deserve the highest commendation.

Whether we like it or not politics now has the job of steering economics in the United States. The voters showed clearly their belief that the Administration pulled us out of the depression. They expect the politicians to prevent the recurrence of depressions and they will be bitterly disappointed and resentful if the politicians fail.

Politicians are wise enough to realize the potential dangers of their position when the rising tide of recovery shall have spent itself. They are therefore honest in inviting cooperation from those who understood the economics of industry.

Industry's leaders have quite as much at stake as have the political leaders. Another depression as serious as the one we have been through may easily wreck the whole economic structure and destroy industry as we have come to know it.

ALTRUISTIC cooperation for the common good is ideal, but cooperation in the common interest reinforced by the selfish interest of all concerned is likely to be more productive of practical results. For that reason we can look on this holiday season with its new spirit of cooperation as one of the most hopeful in many years.

At the moment business is better than it has been in six years and promises to be better during the early months of the new year. May you enjoy your fair share of it, and may your own holidays be happy ones.

Volume 81

DURING the coming year *American Machinist* will celebrate its 60th anniversary. It is the firm resolve of its editors and publishers to continue in this 81st volume of the paper the service to the metal-working industry that has been the major objective since its founding, and to improve that service in such ways as their ingenuity can devise.

American Machinist was started in 1877 by Horace B. Miller, and Jackson Bailey was its first editor. His successors have been, in order, Frank F. Hemenway, Fred J. Miller, Frederick A. Halsey, Leon P. Alford, John Van Deventer and Ethan Viall. Since 1921 the editors have been Kenneth H. Condit and Fred H. Colvin. On the staff that will edit Volume 81 are John Haydock, managing editor; S. Ashton Hand, associate editor; Burnham Finney, western editor; H. R. LeGrand and Ben C. Brosheer, assistant editors; and Paul Wooton, Washington representative.

Depreciation Reserves

A COMMITTEE of the Machinery and Allied Products Institute has just brought in a report recommending the adoption by machinery builders of a consistent depreciation reserve policy. Heretofore the worst penalty for laxness in this matter was a moderate normal tax. Now, however, the undistributed surplus tax adds a stiff penalty that may amount to 27 per cent of book income.

The committee recommends that reserves be used to maintain capital investment intact and to recover cost during the useful life of the asset. Also, that each unit be studied individually because nationally standard rates are not practical, and that it be restudied periodically. Further, that reserves be subjected to budgetary control. The accounting records must tell the executive whether the reserves are set aside in an investment fund, being used to buy new equipment, being borrowed for working capital to avoid bank loans, or really eating up capital.

The policy recommended aims toward the establishment of factual rates supported by records. It is eminently sound and should be generally adopted.

Chips

WASHINGTON—Back on the job after his South American trip President Roosevelt start preparations for inauguration and new Congress, plans permanent CCC, no tax increases, consolidation of government agencies . . . Naval Disarmament Treaty ends, England decides not to scrap five over-age ships, thus leaving way clear for U. S. to do likewise . . . Secretary Woodring calls for stiffening of defense structure by recruiting regular army to authorized strength and raising militia to 210,000 . . . Supreme Court finds Congress can delegate power to President to embargo arms shipments . . . Labor Board sustained by New Orleans federal court judge, TVA curbed by federal judge Gore at Knoxville.

FOREIGN—Chinese crisis precipitated as Chang arrests his chief, Chiang, amid wild charges of Communist and Japanese interference but it blows over . . . Soviet officials have trouble getting local chiefs to observe provisions of new constitution, individual rights being a new idea to many of them . . . Buenos Aires conference accepts treaties that call for conference of 21 American nations in case of war, bar intervention by U. S. or any other country . . . Germany plans further reduction in school and university terms by cutting out vacations . . . Hitler and Goering warn industrial leaders to support 4-year plan with more enthusiasm . . . Rationing of certain foods casts shadows over German Christmas celebrations . . . British manual predicts record warship building program next year . . . Japan puts out feelers for new treaties with U. S.

FINANCE—Last quarter income tax receipts up 15 per cent . . . National debt up to $34,229,000,000 on Dec. 15 . . . Treasury will borrow money to buy incoming gold and keep it from adding to Federal Reserve base.

INDUSTRY—General Electric Schenectady workers vote preference for C.I.O. electrical workers' union over their own works council as bargaining group by 5-4 vote, company occupying entirely neutral position . . . Spread of glass workers' strike closes major units, automobile companies protected by stocks to last several weeks . . . New York labor unions force city to cancel order for office machines from Remington-Rand . . . Rapid growth of demand forces Air Express to convert fast passenger transport planes for exclusive express service . . . Labor Board starts steel hearing . . . Electrical manufacturers sue New York electrical workers' union for over a million in triple damages for "restraint of trade" . . . John Lewis announces major union drive against General Motors . . . 42 steel plant works councils flop to C.I.O. . . . Auto union leader has conference with Knudsen, G.M. executive . . . Chicago & Northwestern restores pay cuts of unorganized workers, part of salary cuts.

INDICATORS—Steel production reaches almost 80 and then subsides a couple of points . . . Business Week's index climbs another half point to 83.4.

Honored by His Company

JAMES F. LINCOLN

Fund Established for Study of Arc Welding

To honor the work of its president, James F. Lincoln, for his work in pioneering the promotion of arc welding and in perfecting equipment and electrodes, the Lincoln Electric Company has just completed plans for a fund and foundation to encourage study and research of benefit to the industry. This fund has been named the "James F. Lincoln Arc Welding Foundation." Dr. E. E. Dreese, chairman of the department of electrical engineering, The Ohio State University, has accepted chairmanship of the board of trustees. A comprehensive program of economic and social significance will be completed soon.

Foundry Equipment Takes Big Jump

Unfilled orders reported by the Foundry Equipment Manufacturers Association jumped to 223.4 in November as against 174.0 in October, a gain of 28 per cent. Since the index for November 1935 stood at 119.2, the present position of the industry is 87 per cent better than it was a year ago. Also, because of its strong November position the three months average of gross orders had a good gain, now standing at 178.6 as against 160.4 for October.

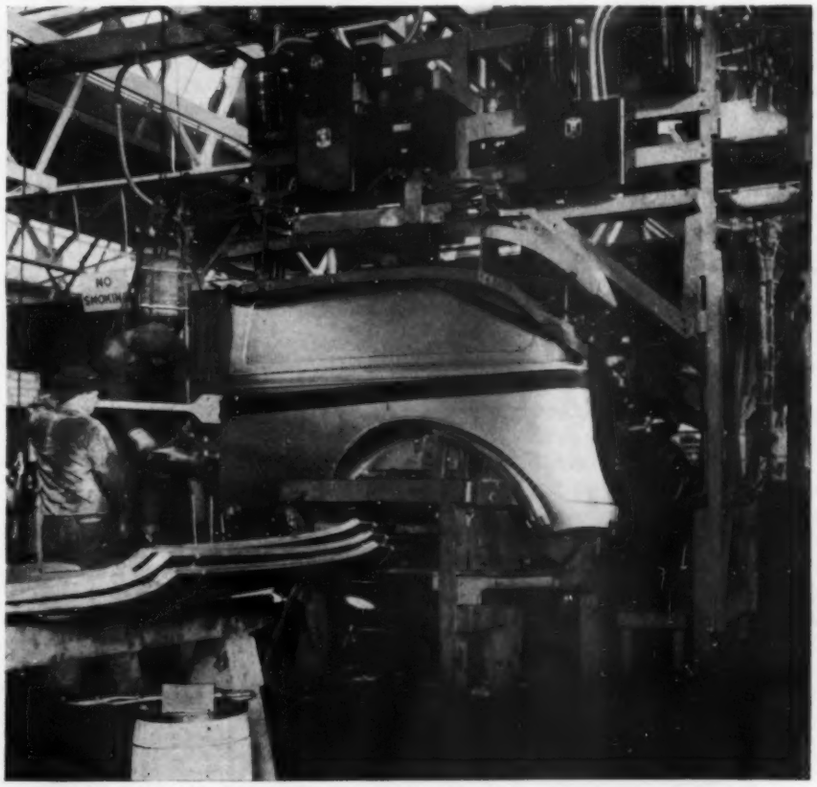
Shipments, on the other hand, declined. Whereas in October this index was 162.9, it dropped to 150.9 for November.

Chevrolet Completes Huge Indianapolis Plant for Commercial Truck Bodies

With capacity of 2,000 bodies per day, the new Chevrolet commercial truck body plant at Indianapolis is considered the largest in the world devoted to this product. Officials of General Motors, Chevrolet and Indianapolis civic authorities formally opened the plant on Dec. 18. That evening, W. S. Knudsen, executive vice-president of General Motors, M. E. Coyle, president of Chevrolet Motor Company, and other officials were guests of honor at a banquet given by the Chamber of Commerce. The plant will employ about 1,400 men.

Six years ago the company bought the plant of the Martin-Parry Co., which consisted of six two-story wooden buildings. The new plant was built section by section around the old plant and gradually replaced it, department by department, so that not a single day's production was lost. During the transition period in each part of the work, conveyor lines were housed in the open under temporary tin roofs. The new plant contains nearly half a million square feet of floor space and has the capacity to supply all of Chevrolet's domestic and foreign requirements. Fifteen body types will be made.

Sides of the buildings are almost entirely of glass, and almost three miles of conveyors have been installed to handle work in process. A modern ventilating system utilizes fans spaced in the trusses of the heating system at intervals of 80 ft. to assure an ample supply of cool air in summer and warm air in winter. The plant has its own flood control system to care for any emergency which might arise from the overflow of the White River on the banks of which it is built. A powerful automatic pumping system, capable of pumping 6,000 gallons of water per minute, has been installed. There is little danger, however, in view of the strong dyke along the river's edge. There are more than 100 presses in the plant of various sizes and kinds. Three of them are among the largest in use anywhere, standing 88 ft. high and weighing over 340 tons.



In Chevrolet's New Truck Body Plant—The body shown in the welding jig is one of the 2,000 commercial truck bodies that the plant is capable of turning out daily. Some 500,000 sq. ft. of floor space will be used to produce the company's domestic and foreign requirements

Machinery Exports For October Best In Five Years

In October exports of industrial machinery were valued at $16,003,332, the highest volume since June 1931, according to the Machinery Division, Department of Commerce. In addition the value of these shipments was 36 per cent ahead of October 1935.

Distribution of the increase covered most machinery lines. Value of the construction and mining machinery that went abroad was $1,636,385, 140 per cent more than a year earlier. Foreign sales of mining, well and pumping machinery reached $3,343,102, a 38 per cent advance. Most of this increase took place in ore crushing and sorting machinery which was valued at $489,724 compared with $190,958 a year ago, and in the exports of petroleum and gas well drilling apparatus amounting to $842,483 against $475,102 last year.

Exports of power-driven metal-working machinery advanced slightly, the amount being $3,883,006 as compared with $3,276,152. Lathes were in strong demand, the value exported being $538,459 as compared with $302,176. Other categories are as follows: vertical boring mills and chucking machines to $384,240 compared with $69,222; of thread cutting and automatic screw machines to $323,599 from $236,116; of vertical drilling machines to $71,969 from $7,512; of gear cutting machines to $245,177 from $128,110; of drilling machines to $226,503 from $116,594; of sheet and plate metal working machines to $328,031 from $115,357; and forging machinery to $127,036 from $68,604. The shipments of grinding machines, rolling mill machinery, and foundry and molding equipment declined, it was stated.

The ten-month total value for industrial machinery exports this year aggregates $140,489,759, which was $18,622,079 above the twelve-month total for last year, according to the Commerce Department.

Tool Orders Almost Reach Year's High

Despite a short month broken by holidays, the November index of machine tool orders was up sharply for the second consecutive month. The increase over October is 10.6 points, bringing the index to 147.1, just three points below July's record for the year, 150.1. These figures were reported by the National Machine Tool Builders Association.

Domestic orders were at approximately the best level for the year, comparing favorably with April in this respect. Foreign orders accounted for 25 per cent of the business booked, and were better in November than in any month since July.

Considerably more than one-half the companies have bettered their 1926 level of business. One quarter of the concerns can show a 200 per cent increase over that year, while the lowest quarter of the group has not been able to get more than 60 per cent of their 1926 sales.

Index of Machine Tool Orders

Based on Volume of Shipments for 1936

Month	Index of Orders: Domestic	Foreign	Total	3 Months' Average Index	% Foreign to Total Orders
1935—November	79.2	19.4	98.6	93.8	19
December	78.1	20.2	98.3	99.9	21
1936—January	95.7	15.1	110.8	102.6	14
February	99.8	12.3	112.1	107.1	11
March	89.0	16.3	105.3	109.4	15
April	110.9	14.8	125.7	114.4	12
May	95.7	23.2	118.9	116.6	19
June	106.5	22.3	128.8	124.4	17
July	104.4	45.7	150.1	132.6	30
August	96.1	31.4	127.5	135.5	24
September	82.9	35.6	118.5	132.0	30
October	105.4	31.1	136.5	127.5	23
November	110.7	36.4	147.1	134.0	25

Distribution of Orders

Average Indexes of Individual Companies	Companies in Per Cent of Total Number Reporting: 1935 1st Quar.	1935 2nd Quar.	1935 3rd Quar.	1935 4th Quar.	1936 1st Quar.	1936 2nd Quar.	1936 3rd Quar.	1936 Nov.
200-up	40.2	5.8	14.2	11.3	13.0	17.2%	15.8%	23.1%
100-199	12.5	15.8	22.1	24.3	24.6	32.6	28.8	35.6
60-99	16.9	22.0	17.2	21.7	22.4	19.0	22.9	14.7
20-59	39.6	31.2	31.6	27.7	26.5	21.8	21.7	19.6
Less than 20%	26.8	25.2	14.9	15.0	13.5	9.7	10.8	7.0

Leaves N. M. T. B. A.

HERMAN H. LIND

Herman H. Lind Will Manage Bolt Institute

Herman H. Lind, general manager of the National Machine Tool Builders' Association for the last four years, has resigned to accept election as executive vice president of the American Institute of Bolt, Nut & Rivet Manufacturers. He will take up his new duties January 1 at the Cleveland headquarters of the Institute.

At a meeting of the board of directors of the Machine Tool Association on December 16 the following resolution was passed:

"BE IT RESOLVED, that in accepting his resignation as General Manager, the Board of Directors express to Herman H. Lind the appreciation and thanks of all the members of the high achievements attained by the Association under his leadership. Further, the Directors assure him that their sincere good wishes go with him for continued success in his new undertaking."

Tool Engineers Organize Chapter in New England

Fifty charter members organized the first Connecticut chapter of the American Society of Tool Engineers at Bridgeport. This is the sixth branch to be started in the country. Ford R. Lamb, president, and C. Ray Brunner, secretary of the national association were present. R. C. Bullard of the Bullard Company showed moving pictures of his company's products and described their operation.

Claus Greve, founder of the Cleveland Pneumatic Tool Co. and the Champion Machine Forging Co., died Dec. 20 at 82.

Motors AND OTHER MATTERS

Strikes in some plants are settled, unions threaten others . . . U. A. W. spars with General Motors . . . Civic authorities won't oust sit-downers . . . Glass shortage acute . . . Trade Commission forces out F. O. B. prices

BURNHAM FINNEY
Western Editor

DETROIT—Car manufacturers have only one subject on their minds these days—how to keep their plants operating in the midst of a plague of strikes which has befallen the industry and its suppliers. One shouldn't be fooled by the sudden settlement of strikes at Kelsey-Hayes and the Aluminum Co. and by the decision of the sit-down strikers at the Fisher plant in Kansas City to go home. That action doesn't mean the end of labor troubles. Momentarily, of course, it relieves the pressure on automobile companies caused by a growing shortage of brakes, wheels and other parts. Ford had seriously curtailed production because it couldn't get brakes from Kelsey-Hayes and was about to "pull" dies from the Kelsey plant and remove them to Rouge where the strike ended. Pontiac and Oldsmobile were in a tough spot, the former depending on Kelsey for all its wheels and the latter for wheels for its sixes.

A Secret Parley

Termination of the Kelsey strike followed closely a secret session between W. S. Knudsen, executive vice-president of General Motors, and Homer Martin, president of the United Automobile Workers. The meeting was held on Dec. 22, the day after Mr. Martin had publicly demanded a parley with Mr. Knudsen to discuss conditions in General Motors plants and to attempt to negotiate agreements for G.M. workers. It is said on good authority that Mr. Knudsen informed Mr. Martin that nothing could be done until strikes in parts plants, which were resulting in acute materials shortages, were ended. Hence the haste in cleaning up the Kelsey-Hayes affair. The union put all possible heat on Kelsey's workers to accept the terms offered, which included a minimum wage of 75 cents an hour, no discrimination against strikers and negotiation of certain wage scales after the men returned to work.

The labor situation in General Motors still appears ominous. The United Automobile Workers are threatening to pull a strike at Fisher Body in Flint. Other danger spots exist, where trouble may flare up any moment. What with John L. Lewis concentrating on General Motors as the Simon Legree of the motor car industry and a United States Senate committee announcing an inquiry into G.M.'s labor practices, General Motors will be kept busy with labor matters for some time. The Fisher strikes at Atlanta and Kansas City are still on. Union officials keep hammering away on the idea that a general strike at G.M. plants is not an impossibility.

No Police Action

Incidentally the industry isn't getting much comfort from the attitude of the courts and local authorities. In a local strike outside the automobile industry the court held that sit-down strikers, so long as they remain peaceful, cannot be ousted from a plant. Mayor Frank Couzens refused to use the police to intervene at Kelsey-Hayes. The Detroit Labor News, organ of the Wayne County Federation of Labor, has advised the next group attempting a sit-down strike to arm themselves.

The flat glass industry is still prostrate from strikes. Libbey-Owens-Ford is refusing to grant a closed shop and check-off demanded by the union. It has kept its furnaces hot by yielding to the union in the matter of employing union men for those key jobs; this makes it possible to begin operations again as soon as an agreement is reached, instead of having to wait four to six weeks while furnaces are heated up. Ironically, car makers insisted some time ago that Libby-Owens-Ford place some of its production outside Toledo because of that city's bad labor reputation. It hastened to build a plant at Ottawa, Ill. The new factory was the first one to be affected by a strike, which started two weeks before it spread to Toledo.

Pittsburgh Plate Glass has been closed by strike for two months and won't be able to swing into production for several weeks after an agreement is signed, because furnaces have been allowed to cool. General Motors, relying on Libbey-Owens-Ford for its glass, is believed stocked for at least a month's requirements, but Chrysler inventories, dependent on Pittsburgh Plate Glass for replenishment, are painfully low. Ford at the moment appears to have enough glass on hand.

Recognition the Issue

Much is said in current strikes about seniority rights, higher pay, a shorter work-week and the speed-up, but the real issue is union recognition. In one plant, the Hercules Motor Co. at Canton, Ohio, the fight is between the C.I.O. and the A .F. of L. The United Automobile Workers (C.I.O. allies) called a sit-down strike and the Machinists' Union (A.F. of L. affiliate) used newspaper advertising to tell the public that the strike wasn't justified and that its members want to go back to work and fulfill the obligations of a contract with the management which runs until next June.

With the industry not sure whether it is afoot or horseback so far as uninterrupted production is concerned, it is impossible to forecast output. Perhaps it is enough to say that consumers and dealers can absorb all the cars the industry can build in the next 30 days. The lag in operations already caused by strikes in itself assures continued top production during the entire winter.

The commercial car and truck branch of the industry is convinced that its market in 1937 will be limited only by its capacity to produce. To illustrate the tight situation: Chevrolet has built about 60,000 trucks of its '37 models, yet its 10,000 dealers have only 5,000 on their floors, the remainder having been delivered to customers. Chevrolet will have more severe truck competition than ever from within G.M. ranks. General Motors Truck is beginning an aggressive campaign in the light truck field, is attempting to interest Pontiac, Olds and Buick dealers in handling its line. The industry probably could sell a million trucks the coming year (including export) if it could make them, but its capacity is only about 850,000.

Prodded by the Federal Trade Commission, the industry has abandoned the practice of quoting F.O.B. factory prices in its advertising. Factory prices have been meaningless. A Ford 60 coupe, bearing an F.O.B. Detroit tag of $480, actually costs $566 delivered in this city. A Dodge business coupe produced in Detroit and priced at $640 at the factory costs the local purchaser $740.50 delivered. Included in the spread between the factory and delivered price is a group of accessories such as bumpers and spare tire without which no car is operated. Then there is a healthy charge for conditioning the car. Hereafter advertised prices will be the delivered price in the city where the company's main plant is located. This means that advertised prices will be much higher, although the actual cost to the consumer will remain the same. The result is that most car makers, at least temporarily, will omit prices from their advertising. A few times in the past individual companies have experimented with advertising local delivered prices, but the plan proved impractical because the prices varied in each city, town and village.

Equipment buying is light, but promises to take a spurt early in the new year. Chevrolet is understood to have a small motor ready to put into production in competition with the Ford 60 motor if sales strategy indicates that such action is desirable, but thus far Chevrolet officials are unconvinced that a car powered by a small motor is necessary. Ford is reported to find the cost of building the small engine excessive and is contemplating abandoning the use of stainless steel plates which now are welded to the cast iron block to form the water jackets.

A parts company which has done much research work with molded plastics is said to have developed a molded steering wheel for automobiles which is produced by an injection molding process, entire wheels being turned out at incredible speed. Such wheels are not yet in production, but at least one company is considering specifying them.

Japanese Forging Engineer Will Visit United States

Yonekechi Horioka, chief engineer of the Tokyo Drop Forge Company, will arrive in New York about the middle of January from Europe. His company proposes to double its capacity and to secure the latest type drop forging equipment either here or abroad. Mr. Horioka is particularly interested in meeting American manufacturers. He will be reached through the New York offices of the U. S. Department of Commerce and the Mitsui and Mitsubishi Trading Companies.

Paris Tool Show Cancelled

The contemplated 1937 International Machine Tool Exposition that was to be held in Paris next year has been called off, according to M. Garanger, president of the Association of Machine Tool Manufacturers in France. There are two reasons for the cancellation: first, lack of a suitable place, and second, the inability of the British manufacturers to participate.

Average Hours Worked Have Gained Slightly

Average hours worked per week in manufacturing industries have increased slightly since the NRA, but are still below the average of 40 hours a week then set as a minimum for most industries. During the NRA period, the National Industrial Conference Board reports in a study just made, the work week averaged 35.6 hours. When the act was found unconstitutional by the Supreme Court, the average increased sharply to 37 for the period from June to December, 1935. The 1936 increase has been slight.

Hourly earnings now are practically the same as at the end of NRA, during the life of which they advanced 42 per cent. Employment has increased, also, and real earnings, or the purchasing power of wages, were 6.4 per cent higher in September, 1936, than during the period of the NRA.

Industrial Review

• FROM practically every industrial center of the country comes word that December was the banner month of a good year and that prospects for the first quarter of 1937 are very bright. Price increases for several lines of machine tools scheduled for the first part of January have unquestionably had some effect in stimulating the placing of orders in December, but there is a feeling in the trade that buyers are so badly in need of equipment that they will continue to place orders regardless of prices. On the other hand several distributors report vigorous objection to the price increases on the basis that they are unjusified at the present time.

• THE EASTERN TERRITORY is extremely active, according to reports from Boston, New York and Philadelphia distributors whose salesmen cover this region. December has been the biggest month since the war and it is expected that 1937 will maintain this pace. Plenty of orders and inquiries are keeping Pittsburg distributors on the jump and they expect the rush to continue.

• IN CLEVELAND it is expected that 1937 will be a period of good volume despite labor trouble and legislative handicaps, but it is a question whether profits will rise with volume. December was the best month of the year and there is some thought that a short lull may succeed it. Detroit says that optimism is general in that part of the country. Much good business has been placed with machine tool distributors and more is in prospect. There is some pessimism over the threat of labor trouble. Machine tool orders are coming into Cincinnati offices on a war basis.

• IN ST. LOUIS the year is going out with a whirl, December being much the best month of the year. Distributors there are decidedly optimistic on 1937. Chicago takes an equally optimistic view of the first quarter of 1937, and so does Milwaukee. Business generally seems to have increased about 30 per cent over 1935 and promises to increase another 30 per cent next year.

• THE BEST YEAR since 1929 is the verdict of West Coast machinery men on 1936, and the best year ever is their prediction for 1937. Making the 1936 showing even more impressive are labor troubles which have halted all western shipping during most of the last quarter of the year. December, usually a bad month even in normal conditions for the western machine tool business, is reported exceptionally good.

Watching Washington

President's message should clarify Congressional program . . . Boom control is getting attention . . . Supreme Court postpones action on Wagner Act . . . Army and Navy plan industrial mobilization

WASHINGTON—Next week, the two-ring circus that is Congress will pitch its tent for a new stand. Despite the customary clowning, two-horse riding and flying trapeze acts, the aggregation is quite likely to fall in line when the ringmaster cracks his whip.

Details of the program should be clarified during the first act when the President delivers his message to Congress. The budget may go up next day.

During the first week of the session, a supplemental estimate for WPA will be sent to Congress. This estimate is expected to amount to $500,000,000, with a later estimate to be made in March when more is known about the demands that will be made on the fund.

Restraint Succeeds Recovery

To the three R's in the Administration's lexicon—Relief, Reform and Recovery—a fourth has been added—Restraint. Forward buying of goods has assumed such proportions that officials no longer deny that the situation has taken on an inflationary look. Talk of recovery has changed to talk of control, and New Deal thought is in the direction of sitting on the bulge. When such thoughts reach the stage of official pronouncement they will likely be of "stabilization."

Furthermore, something probably will be done about it. One step will be to raise bank reserve requirements high enough to absorb all but a small part of the present huge excess reserves. Newly imported gold will be sterilized to prevent it from mingling with the stream of bank money. Though this action will not curtail bank lending now, it will prevent large potential expansion of bank loans, according to the well informed.

There seems to be little thought of raising rediscount rates at this time as member banks are not borrowing much. The Treasury will need low rates for its borrowing program until around the middle of 1938. Cheap money to promote recovery is demanded by business and agriculture.

Clarification Delayed

Clarification of labor legislation will be delayed on account of the Supreme Court's postponement of arguments on the constitutionality of the Wagner labor relations act. Attributed to the illness of Justice Harlan F. Stone, this move will defer hearings to the week of February 8 and decision until March or April.

An expected labor demand is amendment of the Walsh-Healey act to include wage and hour regulation on government contracts below $10,000 which are not covered by the present law. Since government purchasing agents are complaining loudly against the law as it now stands, such Congressional action is doubtful.

The Department of Labor has adopted an ostrich-like attitude of refusing to see any difficulty in purchasing what the departments need. It is known, however, that a few weeks ago the Navy failed to get a single bid on 2,600,000 lbs. of copper, is having difficulty in securing certain forms of steel products and regards the machine tool situation with misgiving. With the difficulties in purchasing aircraft and parts resolved, a recent weekly list of successful bidders subject to Walsh-Healey stipulations included Curtiss-Wright, United Aircraft and Eclipse as willing conformers. Other firms agreeing include General Electric, Westinghouse, du Pont, American Bridge and Allis-Chalmers. Large oil companies and textile manufacturers seem also to have fallen in line.

What will happen when the law gets more drastic is another question. Hampered by lack of adequate personnel, the Department has so far refrained from setting up any minimum wage scales. If the Department adopts a realistic attitude all may be well, but if its policies reflect organized labor's aspirations, bidding will quietly drop from the field.

Munitions Board Wants Law

Five objectives are sought by the Army and Navy in a joint revision of the industrial mobilization plan:

1. Decentralization of wartime munition administration and production;
2. Lighter loads on more manufacturers;
3. Limitation of war profits to normal;
4. Prevention of undue plant enlargement and its evils; and
5. Quick adequate procurement in lieu of a large standing army.

To secure the orderly process of law behind its plan, the Munitions Board will ask Congress for an act authorizing price fixing, commandeering, setting of priorities and requisitioning at fair prices.

The War Department does not favor nationalization of munitions manufacture. State factories are maintained only as a check on prices and quality, not for the volume of weapons they can produce. It favors licensing armament firms to sell abroad during peace time (within technological secrecy limits) to sustain their business and to keep their hands in. Only the strictly military phases of mobilization would be handled by the military; the rest would be handled by civilians in war time.

Work for Water Power

The controversial St. Lawrence treaty is sure to come up again this session. Whether it will be ratified is open to doubt, but with this and other developments involving the generation of water power, members of Congress are impressed with the showing that Bureau of Mines has made as to the possibilities of electro-metallurgical processes which carry a promise of building up industries that would form an important market for power.

Support for such research is almost unanimous because it looks to the creation of non-competing activities and the development of materials now imported. So far as members of the committees on mines and mining have been able to learn there is no opposition to a reasonable program looking to the development of electrolytic manganese, carbon-free metallic chromium and antimony.

Dr. Eckener Will Speak at the S.A.E. Annual Meeting

Members of the Society of Automotive Engineers who attend the annual meeting in Detroit, Jan. 11-15, will hear Dr. Hugo Eckener, of Zeppelin fame, at the dinner on Thursday night. It will be recalled that Dr. Eckener's latest dirigible, the *Hindenburg*, plied between the United States and Germany on a definite schedule last Summer and is now engaged in the South American traffic. He and his associates have been considering terminal facilities in this country, and he should have much to say about the performance and feasibility of the lighter-than-air ship in commercial work.

Others on the program are Ralph R. Teetor, president of the society and Harry T. Woolson, president-elect.

Most of the papers to be given during the five days of technical sessions are of interest mainly to the automotive engineer. Topics to be covered are: fuels and lubricants, diesel engines, passenger car safety and passenger car bodies, piston rings, tractors and aircraft. Three papers of particular interest to the production man are to be given during the latter half of the week. On Thursday afternoon G. O. Hoglund of the Aluminum Company of America will speak on "Spot and Seam Welding of Aluminum Alloys." On Friday evening the Production Session will feature the two papers: "The Development of Close Machining Practice in Automotive Production" by Fred Pyper of the Buick Motor Company, and "Budgeting Expense and Cost of Handling Materials in Automotive Plants" by George Miller, budget supervisor of the Chrysler-Kercheval plants of the Chrysler Corp.

Scientists Will Discuss Metals at M.I.T.

Recent developments in the physics and chemistry of metals will be discussed at a meeting at the Massachusetts Institute of Technology, on January 28 and 29. The program is being jointly sponsored by the Institute and the American Institute of Physics. Leaders in the fields of physics, metallurgy and chemistry will also explore the opportunities for still greater advances through cooperative effort.

Some of the papers to be presented are: "Research Problems in the Steel Industry," by Dr. E. C. Bain, United States Steel Corporation; "Inclusions in Ferrous Alloys," by Dr. A. B. Kinzel, Union Carbide & Carbon Company; "Flow Phenomena in Heavily Stressed Metals," by Prof. P. W. Bridgman of Harvard; "Electronic Structures in Metals and Alloys," by Prof. J. C. Slater, head of the Institute's Department of Physics; "Corrosion," by Dr. J. R. Burns of the Bell Laboratories; "Elastic Properties of Ferrous Alloys," by Prof. A. V. de Forest, of Technology; and "Chromium-Nickel-Iron Alloys," discussed by Dr. V. N. Krivobok of the Allegheny Steel Company.

Alex Dow Awarded Medal by Electrical Engineers

The Edison Medal for 1936 has been awarded by the American Institute of Electrical Engineers to Dr. Alex Dow, "for outstanding leadership in the development of the central station industry and its service to the public." The Edison Medal was founded by associates and friends of Thomas A. Edison, and is awarded annually for "meritorious achievement in electrical science, electrical engineering, or the electrical arts" by a committee consisting of twenty-four members of the American Institute of Electrical Engineers.

The medal will be presented to Dr. Dow during the winter convention of the American Institute of Electrical Engineers to be held in the Engineering Societies Building, New York, N. Y., January 25-29, 1937.

Doctor Dow was born in Glasgow, Scotland, in 1862, and although he is not a graduate of a technical school, he has received the honorary degrees of master of engineering (1911) and doctor of engineering (1924) from the University of Michigan and doctor of science (1935) from the University of Detroit.

In 1893, he accepted the opportunity to design and supervise the construction of the original public lighting plant of the city of Detroit, and in 1896 he became vice-president and general manager of the Edison Illuminating Company of Detroit. This company was succeeded by the Detroit Edison Company in 1903, and Doctor Dow was retained as vice-president until 1913, when he was made president.

Stone is Advanced

R. E. Stone has been named vice-president in charge of manufacturing of the Graham-Paige Motors Corp., Detroit. He has been in the automobile industry since 1915.

Higher Wages Are Paid in Screw Products Industry

Wages paid out by manufacturers of screw-machine products and wood screws in 1935 were 22 per cent higher per employee than in 1933. The average wage was $1,120 as against $874. These figures are adduced from the 1935 Census of Manufactures being compiled by the Bureau of the Census, Department of Commerce.

Total wages in 1935 amounted to $16,825,014, were 88 per cent more than disbursed in 1933 and went to 15,018 persons as compared with 10,236 in the earlier year. There were 302 establishments reporting in 1935 and 255 in 1933. Thus since the number employed increased only 46 per cent and the total wages increased 88 per cent it is plain that the workers benefited materially by the upturn in business.

Value of the products made in this industry last year amounted to $63,029,478, representing an increase of 88 per cent over the 1933 figure of $33,449,458. The industry still is 40 per cent short of the 1929 output when the value was $105,974,662.

D. J. Gregory Becomes Head of Farquhar Press Design

D. J. Gregory, who has had experience in both Europe and the United States as a designer of high-speed hydraulic presses, has joined A. B. Farquhar Co., Ltd., York, Pa., as chief engineer of the hydraulic press division. The Farquhar Company is expanding its hydraulic press division, which includes high-speed production presses, hot and cold process presses, and automatic and semi-automatic types.

In Europe, Mr. Gregory's experience includes that with the Krupp plants in Germany, and the Putilov Works in Russia, while that in the United States includes Bethlehem Steel, Southwark Foundry & Machine Co., Birdsboro, Farrell Birmingham, and Baldwin-Southwark.

Ernst Anheuser

Ernst Anheuser, who organized the Racine File Co. in 1901, and later the Anheuser Mfg. Co., manufacturers of mechanics' tools, died Dec. 9 at the age of 74. His sons, Ernst Jr., is president and Alfred is vice-president of the M. J. Skubal Co., Milwaukee, specialists in welding.

Japan Builds Home Machinery Industry, Increases Exports to Certain Areas

Further evidence of Japan's eagerness not only to become self-sufficient in machinery manufacture, but also to capture machinery markets in certain portions of the globe, is apparent from the continued industrial development and expansion taking place there. Many large undertakings are now underway, but domestic machinery is being specified wherever possible in line with the nationalistic preference. Much equipment is still being bought abroad, however, as the table shows:

Indicative of the trend toward buying at home are the following examples: The Ebara Seisakusho (Engineering Works), according to the Tokyo office of the U. S. Bureau of Commerce, will spend 800,000 yen on 60 machine tools of the better grade. Of these, 40 are lathes to be obtained locally. Boring machines, grinders, millers, and radial drills will be gotten from German and Swiss sources. The Manchuria Aviation Company will spend 500,000 yen, but all except special machinery will be purchased at home. The Nagoya arsenal will soon place an order for machinery estimated at 2,500,000 yen for establishment of an airplane factory. Estimates are being solicited from local builders. Others are following the same practice.

Japanese government agencies are active in finding out the status of the home machinery industry and in standardizing machine tools. Recently the Ministry of Commerce and Industry collected detailed statistics from 8,401 establishments employing 30 or more people. Evidently this number of plants includes both builders and purchasers of machinery. The purpose was to discover machinery orders issued by Japanese manufacturers and the orders received by sub-contractors.

To Stabilize Tool Industry

The same ministry has been holding a series of conferences with Army and Navy authorities and the Bureau of Resources, the purpose being to explore the possibilities of stabilizing the machine tool industry. This has been urgently requested by the five leading builders in Japan. There is said to be an excessive difference between productive capacity and demand in the eventuality of a depression. Although the difficulties in the path of stabilization are realized, the ministry is reported to have suggested the following:

1. The makers should undertake a study of heavy industrial machinery hiherto in little demand in Japan. Develop exports to the South Seas (South Seas according to local usage means the Philippines and the Dutch East Indies).

2. The builders should organize and assist the medium and small makers to improve the quality of their products.

3. Diversification or a change of product should be undertaken.

It is understood the five leading machine tool builders will put standardized machines on the market. Designs have already been submitted to the authorities and two or three makers have already undertaken manufacture of the standardized machines.

The following machines may not come in the above category since they were first placed on the market in 1935. They are built by the Ikegai Iron Works of Tokyo, and embody the results of a study commenced in 1932. The first is a high-speed lathe for precision work and to use tungsten carbide. Spindle speeds go up to 1,500 r.p.m., the higher ones being obtained through a round belt drive from 5 hp. motor. Another lathe, of universal pattern, is also intended for high speeds. The company's new miller is built for precision work and high speed.

Of the machinery being imported into Japan, the United States enjoys the largest and an increasing share. In

Japanese Imports and Exports in Machinery

In Thousands of Yen

IMPORTS

By Items	1933	1935	Jan.-Aug. 1936
Total	70,859	102,676	*61,426
Internal Combustion engines	16,148	15,559	.....
Steamboilers	1,791	6,110	.....
Locomotives	156	2	.....
Steam turbines and parts	343	1,331	.....
Economizers	124	733	.....
Cranes, etc	176	98	.....
Sewing machines	2,184	6,474	.....
Pumps, compressors	1,396	1,764	.....
Hydraulic presses	5	1,481	.....
Metal or wood-working machinery	16,248	18,296	.....
Knitting machinery	82	1,645	.....
Other textile machines	3,649	5,102	.....
Printing machinery	21	503	.....
Rolls and rollers	241	916	.....
Card clothing	2,441	3,869	.....
Cutters and saws	267	417	.....
Paper making machines and equipment	1,387	1,887	.....
Pneumatic tools and machinery	256	588	.....
Other machinery	11,726	16,974	.....
Other parts of machinery	12,108	18,823	.....

* Details not yet available.

By Countries

United States	21,878	38,389	24,627
Germany	15,979	28,225	17,016
England	12,205	21,779	11,007
Sweden	3,665	5,919	3,877
France	3,423	2,974	1,266
Switzerland	2,006	2,699	2,671
All other	11,703	2,691	961

EXPORTS

By Items	1933	1935	Jan.-Aug. 1936
Total	23,133	55,814	*48,851
Steamboilers	577	1,901	.....
Pumps	900	1,623	.....
Metal or wood-working machinery	566	1,141	.....
Spinning machinery	4,879	8,978	.....
Weaving machinery		3,569	.....
Printing machinery	900	1,105	.....
Locomotives	**	13,777	.....
Cranes	**	1,122	.....
Internal combustion engines	**	1,910	.....
Sewing machinery	**	365	.....
All other machinery	15,301	19,523	.....

** Included with "All other machinery."

By Countries

Kwantung	14,197	34,779	25,082
China	4,951	15,310	10,008
British India	2,105	3,071	1,878
Manchuria	1,938	5,607	3,597
Asiatic Russia	1,329	1,106	4,785
Netherland India	312	803	625
Philippine Islands	197	389	321
Hong Kong	119	195	58
Brazil	104	204	184
Australia	31	114	74
All other	573	2,279	2,239

Patent Listings

A request has been made that we resume publication of the listings of patents in the metal-working field formerly published in this section of *American Machinist*. The editors would appreciate advice from readers as to whether or not this feature is useful and wanted. If we hear from enough readers that they wish us to restore patents as a regular feature we shall be only too glad to do so.

1933, its share was 31 per cent but by 1935 this had grown to 37 per cent. A further increase is shown for the first eight months of 1936, when 40 per cent of the total went to American sources. Germany increased her business somewhat, throughout, while Great Britain held her ground only.

Japan is anxious to build up her exports of machinery to the backward nations of the East and South America. In this connection it can be said that efforts are being made to prevent shipments of shoddy machinery. The hope is that organization of the makers and establishment of standards will be of benefit.

Examples of recent Japanese machinery exports indicate the kinds that are getting acceptance in certain countries:

Japanese-built saw-mill machinery is being exported to China, Indo-China, British India and South Sea countries. Machines already installed are reported to be operating satisfactorily, and more orders are being received by Japanese makers. Freight and other incidental charges are cheaper on saw-mill machinery ordered from Japan.

Rayon machinery makers are reported in the Nikkan Kogyo (Industrial Daily News) to have received inquiries for staple fibre machinery from the Soviet Union, where the development of the staple fibre industry is being encouraged within the scope of the second Five Year Plan. The present inquiries are for machinery having a daily capacity of 50 kg.

Other prospects appear in China. It is reported that the Chinese Government is planning to erect a rayon manufacturing plant at a cost of 20,000,000 yuan. A German maker is reported to have negotiated with Chinese government officials for machinery orders in connection with this project, but in the face of Japanese tenders he had to withdraw.

Japan sold the U. S. S. R. during the first six months of this year 675,000 roubles worth of spinning machinery, 180,000 roubles worth of air-compressors, 247,000 roubles worth of metal lathes, 18,000 roubles worth of metal cutting machines, 100,000 roubles worth of presses and 234,000 roubles worth of other machinery. Plans are under way to invade the India and China markets for pulverizing machinery, previously dominated by England and Germany.

Bicycle Production Hit A New High in 1936

For the first time since 1899, a new record in bicycle output in the United States can be recorded, according to Col. Edward H. Teall, president of the Homer P. Snyder Manufacturing Company of Little Falls, N. Y. The output this year estimated at 1,200,000 machines, some 20,000 better than in the big year just before the turn of the century. Production this year will be almost twice as great as in 1935, and four times the average output for the years 1928 to 1934 inclusive.

Industrial Photography Exhibit Is Planned

An exhibition fully representative of the many fields of applied and scientific photography is being arranged for March at the Rundell Memorial Building in Rochester. Gustave Fassin, of the Bosch & Lomb Scientific Bureau, is chairman of the committee to secure and arrange the exhibits. Many different subjects are to be treated. Examples are high-speed photography (useful in studying machinery in action), micro-photography and metallography.

Familiar Claw Hammer Is Only 100 Years Old

After working thirteen years on a method to temper the curved claws of the claw hammer, Henry Cheney was able to make the first satisfactory tool of this type in 1836. After a century of existence the Henry Cheney Hammer Corp. of Little Falls, N. Y. is still using the technique developed by its founder. From a little blacksmith shop the business has grown so that today the product is shipped all over the world.

Social Security Manual Is Available From N.A.M.

For the convenience of the employer, the National Association of Manufacturers has prepared a "Federal Social Security Act Manual" which gives important facts concerning the act and its workings in digest form. Fifteen topics are covered. Single copies are available free from the association at 11 West 42nd St., New York, N. Y. Request Labor Relations Bull. No. 15.

Representative subjects are: important social security act dates; records the employer must keep; most important old age annuity tax regulations; unemployment compensation tax regulations, and social security board offices.

Other topics are: present status of federal and state cases involving social security legislation; recovery of taxes if legislation is invalid, and a brief explanation for employees of the federal old age annuity plan.

MEETINGS

AMERICAN ROAD BUILDERS ASSOC. Highway equipment exhibit. Jan. 11–15. Exhibit Hall, New Orleans. C. M. UPHAM, 952 National Press Building, Washington, D. C.

CANNING MACHINERY & SUPPLIES ASSOC. Chicago, Ill. Jan. 25–29. F. E. GORRELL, 1739 H St., N. W., Washington, D. C.

FIRST NATIONAL AVIATION SHOW. Grand Central Palace, N. Y., Jan. 28–Feb. 6.

NATIONAL COACH TRAILERS MFGRS. ASSOC. Clearwater, Fla. Jan. 29–Feb. 8. E. H. JUNGCLAS, secretary, 1718 Brockman Ave., Cincinnati.

NATIONAL MOTOR BOAT SHOW. Grand Central Palace, New York, Jan. 8–16. IRA HAND, show manager, 420 Lexington Ave., New York.

NATIONAL OIL BURNER & AIR CONDITIONING EXPOSITION. Philadephia, Pa., March 15–19. C. F. CURTIS, secretary, 30 Rockefeller Plaza, New York.

NATIONAL RAILWAY APPLIANCE EXHIBITION. Chicago, Ill. March 15–18. C. W. KELLY, 910 S. Michigan Ave., Chicago.

PACKAGING EXPOSITION. Hotel Penn, New York. March 23–26. Show managers—Roberts Everett Associates, 232 Madison Ave., New York.

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. Annual Meeting, Jan. 11–15, Book-Cadillac Hotel, Detroit. JOHN A. C. WARNER, secretary and general manager, 29 West 39th St. New York.

PERSONALS

E. L. BACHMAN, is now general superintendent of motive power in the New York zone for the Pennsylvania Railroad. He had been master mechanic of the Philadelphia division.

THOMAS W. DAMEREST, general superintendent of motive power, western region of the Pennsylvania Railroad Co., has been appointed to staff duty with the chief of motive power, Philadelphia. W. Y. CHERRY succeeds him in the Chicago office.

ALEXANDER K. GALLOWAY, who has been superintendent of motive power on the Eastern lines of the Baltimore & Ohio, with headquarters in Baltimore, has been made superintendent of motive power and rolling equipment of the Reading and the Central of New Jersey, with headquarters at Reading, Pa.

CHARLES A. GILL, superintendent of motive power, Philadelphia & Reading Railroad Co. and the Central Railroad of New Jersey, has been appointed general manager of these companies. He joined the Baltimore & Ohio as call boy in 1896, became a machinist, general foreman and master mechanic, and in 1917 became superintendent of motive power, Eastern Lines of the B.&O. In 1931 he spent a year in Russia as chief consulting engineer of the railroad system of the U.S.S.R. He joined the Reading in 1932. He is succeeded by A. K. GALLOWAY, formerly superintendent of motive power, eastern lines, B.&O.

N. M. LOWER has been appointed works manager of the Standard Stoker Company, Inc., with headquarters at Erie, Pa., according to an announcement made by E. A. TURNER, vice-president. Mr. Lower has had long experience in the stoker industry and has been associated with the above company for several years in the New York office.

WILLIAM E. UMSTATTD, president of the Timken Roller Bearing Co., Canton, Ohio, has been elected president of the subsidiary Timken Steel & Tube Co., to succeed FREDERICK J. GRIFFITHS, resigned. H. H. TIMKEN, JR., vice-president and a director of the bearing company, has been elected executive vice-president of the steel company, of which he had been a vice-president previously. W. ROBERT TIMKEN was elected director of both companies to fill the unexpired terms of Mr. Griffiths.

G. S. MCKEE has been appointed general superintendent of the Globe-Wernicke Co., Cincinnati, according to an announcement by J. S. SPROTT, president. Mr. McKee will act as chief assistant to F. A. SCHMITZ, vice-president in charge of production. Recently Mr. McKee resigned as head of the production engineering division of the Baldwin-Southwark Corp., Philadelphia. Before that he had been production manager of the Timken Roller Bearing Co. for several years.

Joins Bay State Abrasive

Bachrach Photo

EARL C. HUGHES

EARL C. HUGHES, assistant sales manager of the Norton Co., Worcester, Mass., resigned recently to affiliate himself with the Bay State Abrasive Products Co., Westboro, Mass., as secretary. Mr. Hughes had been with Norton for eighteen years in various sales capacities.

WILLIAM J. JOCKERS, has been appointed assistant sales manager of the Diehl Manufacturing Co., Electrical Division of the Singer Mfg. Co., Elizabethport, N. J. Mr. Jockers spent 26 years with Westinghouse in various manufacturing and jobbing capacities.

H. B. KRAUT, president and general manager of the Giddings & Lewis Machine Tool Co., returned recently on the Rex from a business trip to Europe.

J. B. MCCRACKEN, a special engineer of the Transue & Williams Steel Forgings Corp., Alliance, Ohio, for the past year, has been appointed general manager of the company, succeeding CHARLES T. KINGSTON, resigned. He formerly was identified with the Cleveland Hardware Co.

CHARLES P. POWELL is now manager of the Crane Co.'s plant at Tonawanda, N. Y. He takes the place of WILLIAM E. PETERSON who has been forced to take a leave of absence because of ill health.

HERMAN L. WECKLER has joined the DeSoto division of Chrysler Corp., as vice-president and general manager. He was previously connected with the Jones & Laughlin Steel Co.

M. L. CARLSON succeeds E. A. SHULL, resigned, as superintendent of motive power of the Missouri & Arkansas. Mr. Carlson will be stationed at Harrison, Ark.

WILLIAM G. COSTIN, chairman of the board, Pittsburgh Screw & Bolt Corp. was honored at an employees party on his 62nd birthday recently.

C. HIGBIE YOUNG has been made head of the department of machine design and engineering drawing in the Cooper Union Schools of Engineering, according to an announcement made by GANO DUNN, president of the Union.

O. W. WINTER, formerly general manager of the cutter and special tool division of Whitman & Barnes, Inc., is now industrial engineer with the Kent Owens Machine Co., Toledo.

OBITUARIES

C. L. BOCKUS, 69, who retired as general production manager of the Studebaker Corp. on Dec. 1, died Dec. 17 of heart disease.

HENRY R. EVANS, partner in the expansion bolt firm of F. H. Evans & Co., Brooklyn, N. Y., died Dec. 16 at the age of 65. He was the son of FREDERICK H. EVANS, inventor of the expansion bolt.

EARL C. ROHN, 48, general manager of the Canton Auto Spring Co., Canton, Ohio, died Dec. 10 in that city, following a heart attack. He was for many years identified with the Timken Roller Bearing Company.

FRANK W. RUGGLES, first president and organizer of the Republic Truck Co., died Dec. 7 at Alma, Mich. He was 60. He sold out his interest in Republic in 1920 and then organized the Ruggles Motor Truck Co. of Saginaw. After this he was president of the Northern Wheel Co.

JAMES E. VAN HOUTEN, secretary-treasurer of the Dutchess Tool Co., Beacon, N. Y., manufacturer of baking machinery, died Dec. 6, aged 81.

EXPORT OPPORTUNITIES

* Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office. Please refer to key number.

Machinery, bee-comb-manufacturing machinery, electrically operated. (Purchase.) Kaunas, Lithuania. *2064.

Machinery, boring machines, metal. (Purchase.) Lyon, France. *2080.

Machinery, candy-making machines for making hard candies. (Purchase.) Mexico City, Mexico. *2081.

Machinery, canning and can-making. (Purchase and Agency.) La Paz, Bolivia. *2065.

Machinery, cement-bag-making machines, small sachet-bag-making machines, automatic gumming machines, and high-speed tag-making machines. (Purchase.) Rouen, France. *2071.

Machinery, engines, diesel, stationary. (Agency.) Lima, Peru. *2079.

Machinery, machine tools, such as automatic screw machines, thread-rolling machines, automatic packaging machinery, woodworking lathes, stamping machines, and bolt and wire drawing machines. (Purchase and Agency.) London, England. *2088.

Machinery, oil-pressing machines. (Purchase and Agency.) La Paz, Bolivia. *2065.

Machinery, printing and binding machinery and equipment. (Agency.) Caracas, Venezuela. *2055.

Machinery, saw-milling for small movable mills. (Purchase and Agency.) La Paz, Bolivia. *2065.

Machinery, complete equipment for manufacturing collapsible tubes up to 2 in. diam., and printing on them in three colors. Send quotations to Chemical Industrial & Pharmaceutical Laboratories Ltd., 12 Rampart Row, Fort, Bombay, India.

Brick- and tile-manufacturing machinery. (Purchase.) Salonika, Greece. *2116.

Cement-manufacturing machinery. (Purchase.) Sydney, Australia. *2141.

Machine tools, milling machinery, and mill-furnishing requisites. (Purchase.) London, England. *2118.

Filters, oil, for diesel and semi-diesel engines. (Purchase and agency.) Oslo, Norway. *2151.

Engines, diesel, oil, vertical type. (Agency.) Oporto, Portugal. *2119.

Road-building machinery and equipment, concrete mixers, asphalt-preparing machinery, air compressors, and pneumatic tools. (Agency.) Rio de Janeiro, Brazil. *2117.

Screw machine, automatic, for production of small brass parts. (Purchase.) Pilzen, Czechoslovakia. *2150.

Wheelbarrows, tubular, steel. (Purchase and agency.) Manila, P. I. *2112.

Woodworking and metal-working machinery. (Purchase.) Johannesburg, South Africa. *2120.

BUSINESS ITEMS

The Ajax Flexible Coupling Co., Westfield, N. Y., has appointed GEORGE C. EWING as New England representative for its power transmission equipment with offices at 10 High St., Boston.

The Canadian Sumner Iron Works, Ltd., Vancouver, Canada, is expanding operations and will manufacture coal stoker furnaces and complete heating systems, including air-conditioning units.

Champion Laboratories, Inc., Meriden, Conn., is being organized and established by L. I. HANCE, who resigned recently as advertising and sales manager of the Cuno Engineering Corp. The new company has an authorized capital of $50,000 and will manufacture automobile accessories, beginning in January.

Chapman Transmission Corp., Buffalo, has named George P. Dempler Co., Pittsburgh, its representative for its line of anti-friction bearings and mountings, in the Pittsburgh territory.

Esco Engineering Service Co., maker of the "Esco" drill jig, has moved to larger quarters at 3120 Monroe St., Toledo. Additional machinery is being installed.

J. A. Firsching, Inc., manufacturer of textile machinery will remove its plant soon to larger quarters at 421 Broad St., Utica, N. Y. Additional equipment will be installed.

Lindberg Engineering Co., 221 Union Park Court, Chicago, has appointed GRANT GOODWIN as district manager of the Indiana and Southern Illinois territory. Mr. Goodwin was formerly metallurgist of the Muehlhausen Spring Co., and prior to that was with the Allison Engineering Co. and the Chicago Screw Co.

Mico Instrument Co., is the new name of the former Mann Instrument Co., 10 Arrow St., Boston. The change was made after the withdrawal of DAVID W. MANN. The company makes precision apparatus, such as measuring engines, surface plates and diamond laps.

George D. Miller Co., Cleveland, Ohio, has been appointed Northern Ohio representative of H. R. Krueger & Co., Detroit, for the complete line of drilling, milling, tapping and boring machines and drillheads. The Miller Co. has also been made representative of the Cleveland Planer Co., for open-side planers, in North Eastern Ohio.

The Morrison Machine Products Co., Elmira, N. Y., machinery manufacturers, has started construction of its new plant there, and expects to start production about the middle of February. The building will cost about $50,000, will be 218 by 53 ft.

The Sesamee Co., Hartford, Conn., makers of keyless, combinationless locks, has been forced to double its floor space and the number of employees. New equipment has been installed.

South Bend Lathe Works, South Bend, Ind., has appointed MacKenzie Machinery Co., 25 Huntington Ave., Boston, exclusive distributors in the Boston territory.

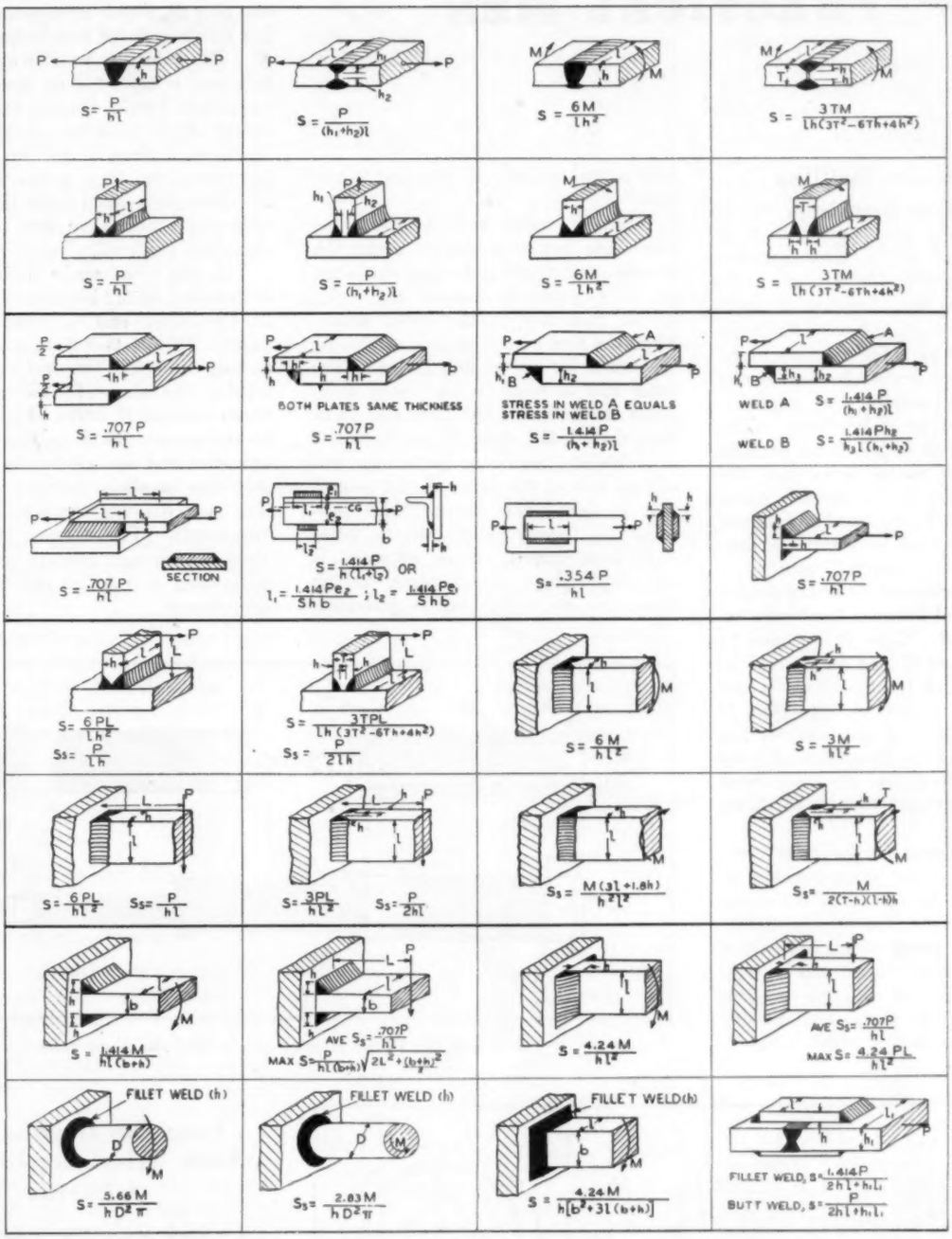
The Warner & Swasey Co., turret lathe builders, has opened an office and warehouse at 409 Velasco St., Houston, Texas, better to serve customers in the Southwest. L. M. COLE, district manager, is in charge and will be assisted by a service representative, J. V. FAL.

The Harnischfeger Corp., Milwaukee, has transferred E. T. BENNINGTON from the Chicago territory to the St. Louis office where he will be in charge. He was a hoist sales engineer at Chicago.

The V & O Press Co., Hudson, N. Y., builder of power presses and automatic feeds, has appointed two new agents: Joseph F. Pflum Sales Engineering Co., Cincinnati; and the National Machine Tool & Supply Co., Minneapolis, Minn.

The Kaustine Co., Inc., Perry, N. Y., tank manufacturer, has started construction of a large addition to house the subsidiary Monarch Tank & Metal Fabricating Corp. Machinery of this concern will be moved to Perry from the old plant at Lackawanna, N. Y.

Stress Formulas for Typical Welded Joints



From a paper presented before the American Society of Mechanical Engineers, Cleveland, Oct. 22–23, 1936, by Charles H. Jennings, engineer in charge of welding research, Westinghouse Research Laboratories.

S = normal stress in weld, lb. per sq. in.*
S_s = unit shear, lb. per sq. in.
M = bending moment, in.-lb.
P = external load, lb.
h = size of weld, in. For fillet welds h represents the weld leg, and for butt welds h represents the throat of the weld excluding reinforcement.
l = length of a weld, in.

* In a butt weld the stress is equal to the load divided by the throat area, $h \times l$. See top figure, first column.

In a transverse fillet weld, the throat section again bisects the included angle of the weld and is considered the critical section. Stress at the throat section is principally a normal tensile stress and equals $1.414\ P / h\ l$.

Ideas FROM PRACTICAL MEN

Fixture for Drilling Floating Bushings

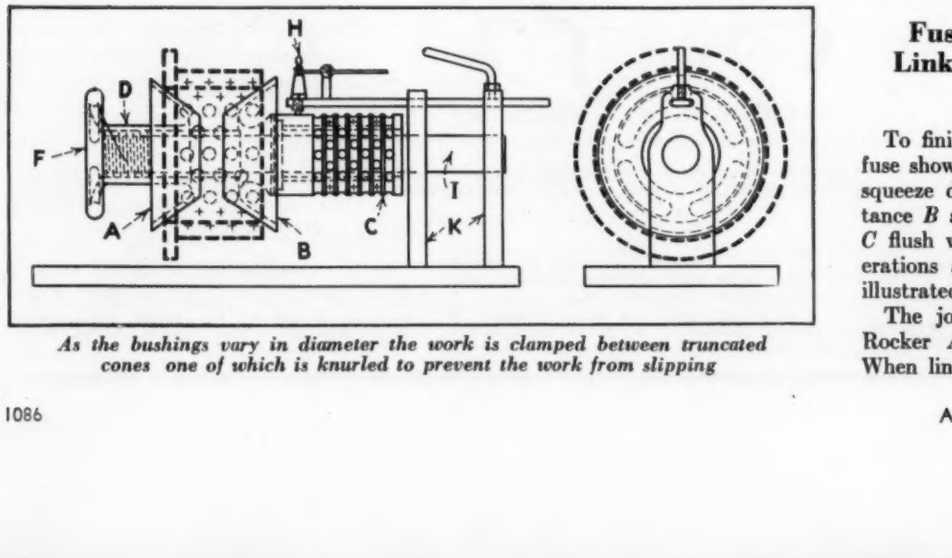
L. S. TAYLOR
Department Foreman, L. & N. R.R.
Louisville Shops

Many locomotives have their main and side rods equipped with bearings that are generally called floating bushings. These are free to float or rotate in the rod and around the crankpin. Grease is used as a lubricant. The bushing is drilled with a large number of countersunk radial holes and the drilling of these holes presents quite a problem. So I developed the fixture illustrated in order to speed up production and afford accurate results.

The work, indicated by heavy dotted lines, is clamped between the truncated cones *A* and *B*. Cone *B* is keyed to the index sleeve *C* and is knurled to prevent the work from slipping. Cone *A* is slidably mounted on the sleeve *D* which is threaded at one end for the threaded hub of the handwheel *F*. By turning the handwheel clockwise cone *A* will move toward cone *B* to clamp the work.

The index sleeve has the same number of holes in the same number of rows as are to be drilled in the work. It is locked in position by the spring-actuated index pin *H* which is mounted on a sliding rod so that it can be used on index sleeves of different lengths. All the rotatable parts are slidably mounted on the shaft *I* which is rigidly held in the uprights *K* attached to the base.

With the work held between the cones, the fixture is aligned under the spindle of the drill press and the index pin is engaged in one of the holes in the first row in the index sleeve. Then the first hole is drilled. Indexing the work for succeeding holes in the same row is done in the usual way. After the holes in the first row have been drilled, the assembly on the shaft is slid along until the index pin will engage one of the holes in the second row in the index sleeve. This procedure is followed until all the holes have been drilled. Since accuracy is not required in the location of the holes, no guide bushing is provided.



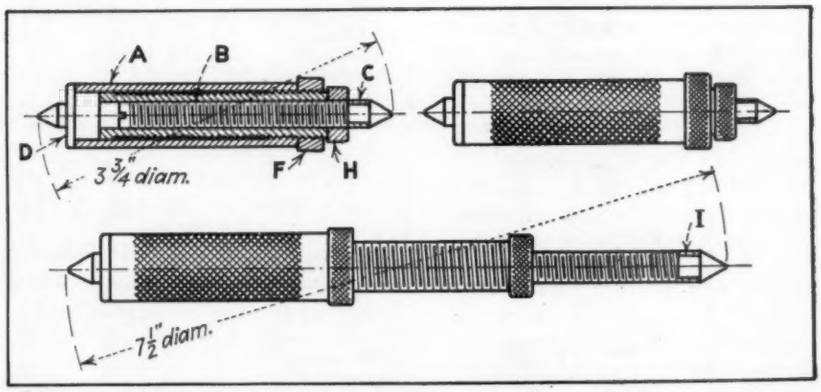
As the bushings vary in diameter the work is clamped between truncated cones one of which is knurled to prevent the work from slipping

Adjustable Telescopic Pin Gage

J. R. WHITTLES

A telescoping, adjustable pin gage for inside measurements from 3¾ to 7½ in. is shown. It consists of the piece of tubing *A*; the sleeve *B;* the pin *C;* the plug *D*, which terminates in a gaging point; and the two locknuts *F* and *H*. The tubing is knurled on the outside and is threaded on the inside far enough to form a bearing for sleeve *B*. Sleeve *B* is threaded on the outside for most its length, and on the inside far enough to form a bearing for pin *C*. The unthreaded inner parts of the tube and the sleeve are relieved to clear the threads.

The pin *C* is made from drill rod is threaded its full length and is pointed at the outer end to form a gaging point. It has two flats at *I* for adjusting wrench. The locknut *F* is for locking the sleeve to the outer tube, while locknut *H* is for locking the pin to the sleeve. Both gaging points are hardened and are spherically ground to suit the smallest hole to be gaged. The part *B* is not threaded for its entire length. The extreme left portion thus has enough land to support the part when it is pulled out for extreme adjustment.



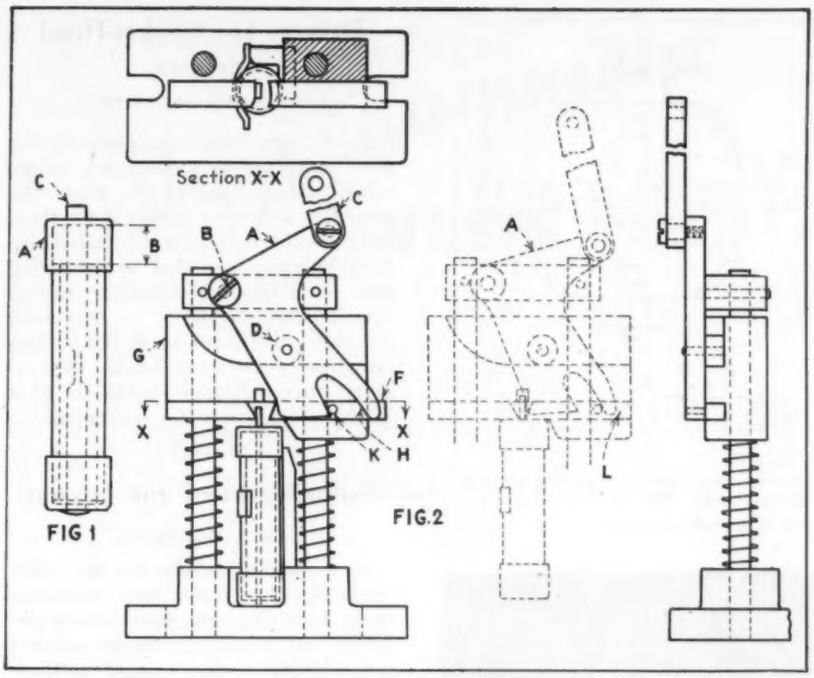
Pin C and the sleeve B telescope within the outer tube

Fuse Cap Driving and Link Trimming Fixture

B. SPECTOR

To finish the partly assembled plug fuse shown in Fig. 1, it is necessary to squeeze down the cap *A* for the distance *B* and then to shear off the tip *C* flush with the cap. These two operations are performed in the fixture illustrated in Fig. 2.

The job was done in a foot press. Rocker *A*, Fig. 2, is pivoted at *B*. When link *C* connected to the ram of



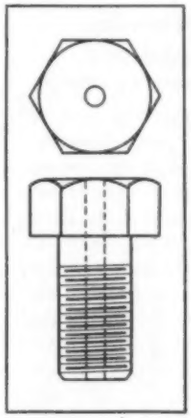
Slide G, actuated by roller D, closes the cap down on the fuse, and then cutter L clips off the surplus fuse link

Drilled Screw Used for Spotting

JAMES W. EMMONS

It is often necessary to drill a shallow hole in a shaft so that a setscrew will correctly position a lever or other part. This spotting is difficult when it is desired to secure the part in a critical location.

A capscrew to fit the tapped hole in the part is drilled lengthwise with a small drill, as shown, and is then case-hardened. With this screw holding the part in position on the shaft, a drill fitting the hole in the screw is used to spot the shaft. Removing the part from the shaft, the spot is used to center a drill of the correct size for the point of the setscrew. Various sizes of capscrews, drilled and case-hardened, will be found useful.



A capscrew like this can be used as a bushing in spot drilling the shaft

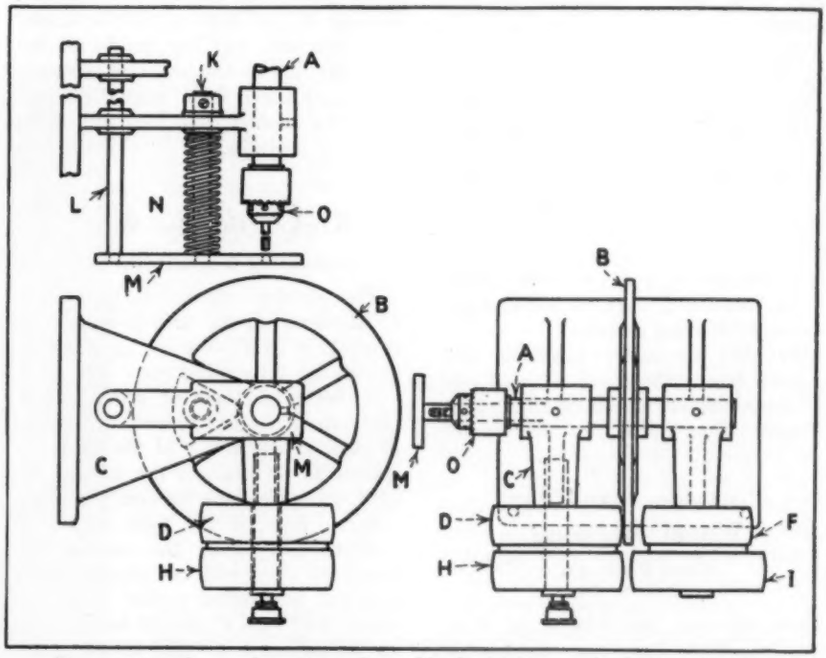
the foot press turns rocker *A*, the roller *D* rides along the cam surface *F* in the slide *G*. This slide is moved down as shown by the dot-and-dash-line figure. When the roller *D* reaches the curved portion of cam surface *F*, downward movement of the slide stops. At this point continued movement of rocker *A* causes the finger *H* to strike the pin *K*, thus driving the sliding cutter *L* to the left and cutting off the surplus of the fuse link.

Simple Tapping Machine for Light Work

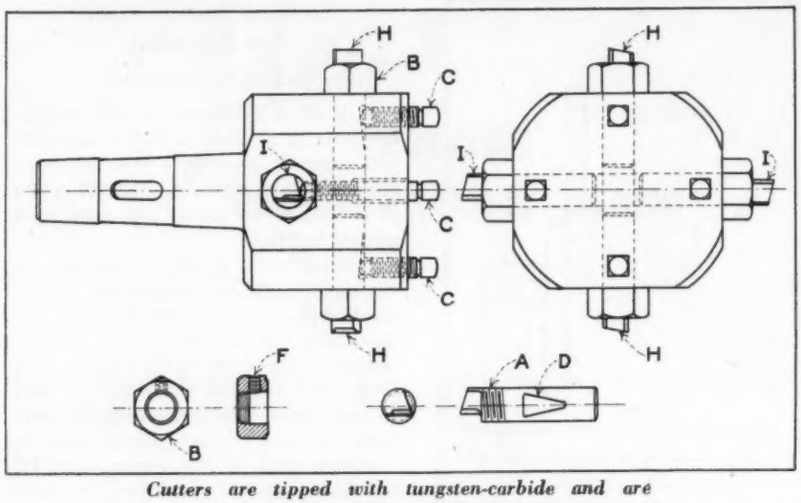
GEO. W. WILSON

A simple and fast tapping machine for light work is shown. The spindle *A* carrying the aluminum friction disk *B* is slidably mounted in its bearing in the frame *C*, so that the disk can be brought into contact with either of the friction wheels *D* or *F*. The drive is by motor through a belt running over the pulleys *H* and *I*, of which the bodies of the friction wheels are an integral part, the bodies being covered with leather.

Also slidably mounted in the frame and guided by the rods *K* and *L* is the work platen *M*. Pressure of the work against the platen compresses spring *N* and forces the spindle back by contact of the tap with the work, bringing the friction disk into contact with friction wheel *F* and causing the tap held in chuck *O* to tap the work. Releasing pressure of the work on the platen permits spring *N* to move it back, causing the tap in the work to draw the spindle forward and bring the friction disk into contact with friction wheel *D*, thus reversing the direction of the spindle motion and backing the tap out of the work. The ratio of tapping to reverse speed can be varied by having friction wheels of different diameters.



By pressing the work against platen M, the tap is revolved; by releasing the work pressure the tap is backed out



Cutters are tipped with tungsten-carbide and are threaded for adjusting nuts, which also serve as stops

Cutter Head for Boring and Counterboring

CHARLES C. TOMNEY
Chief Tool Designer, Carrier Corporation

The cutter head illustrated has two sets of cutters tipped with tungsten-carbide and threaded at *A* for the adjusting nut *B*. The inner ends of setscrews *C* bear on tapered flats *D* on the cutters so that when they are tightened the cutters are drawn inward until the adjusting nuts, which also serve as stops, are firmly seated against the body. After the cutters have been set, the adjusting nuts are locked by the setscrews *F*, under each of which is a brass plug to prevent them from marring the threads on the cutters.

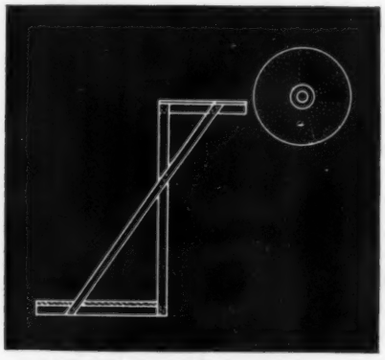
The first set of cutters *H* is for boring the crankcase of our two-cylinder vertical compressor to receive the pilots or spigots on the cylinders, and the second set *I* is for counterboring the seats for the gaskets. The cutters are so spaced, one set ahead of the other, that when cutters *H* have bored the holes for the cylinder pilots and have cleared their inner edges about ½ in., cutters *I* start to counterbore the seats for the gaskets.

We also use cutter heads of this type for boring the crosshead guides in the housings of our horizontal compressors.

Portable Stand for Wheel Dressing

KARL ENGLISH
Buffalo Machine Company

For dressing the wheels of floor grinders that have no permanent steadyrest, I have made use of the portable stand shown. It is made of



angle iron, and can be bolted, riveted, or welded, as desired. The dresser is laid flat on the table which affords a better guide than the operator's hands. Because of the stiffness of the angle-iron members, and the weight of the man standing on the platform, dressing is accomplished in a more thorough and even manner than freehand. The device is portable.

Kinks Did It—Why?

ROBERT S. ALEXANDER

The problem referred to by George J. Murdock in an article under the above title (*AM*—Vol. 80, page 893) is an old but interesting one.

A better method of removing an obstinate arbor is to insert two pieces of steel in the T-slot of the table, so spaced as to straddle the arbor, and with the upper ends between the arbor collars. Now, if the table is moved outward away from the column, the pieces of steel will be sprung and a pull will be exerted on the arbor. A sharp blow with a piece of heavy brass on or adjacent to the thrust collar on the forward end of the spindle will jar the arbor loose.

Drivers for Socket-Head Screws

STANLEY BALDWIN

Aside from their cost, probably the chief objection to socket-head, or so-called safety, screws is that the wrenches or drivers provided for them will not clear adjacent projections. This is easily remedied by providing sets of T-handled wrenches having square shanks about 6 in. long with the blade ends made to fit the various openings in the screw heads. Sets of short drivers having shanks to fit a ratchet wrench are also convenient.

Coloring Steel for Layout

H. R. HAGEMAN

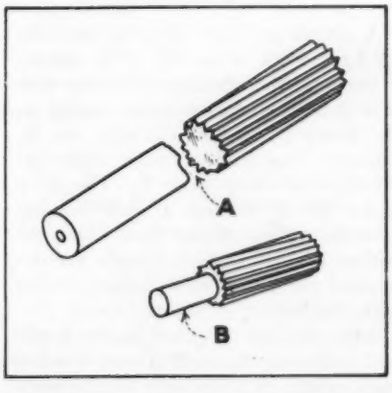
Some diemakers like to blue their die-blocks by heat when preparing them for laying out, while others prefer to coat them with copper, using a saturated solution of copper sulphate and water, to which a little mild acid has been added to clean the steel and to aid in the deposit of copper.

The objectional fumes and the tendency to rust tools when the usual acids are used may be avoided by using oxalic acid in the copper sulphate solution and following the application by a thin film of oil. Lactic acid is also effective.

Use for Broken End Mills

C. H. WILLEY
Superintendent of Manufacturing, Hoyt Electrical Instrument Works

When a small end mill is broken at the neck where the body joins the shank, as at *A*, it should not be



thrown away. By grinding down the body near the broken end to form a small, straight shank, as at *B*, the end mill can be used in either a collet in a small milling machine, or in a chuck attached to a flexible shaft.

Shop Equipment NEWS

Rowbottom Model 325 Cam Milling Machine

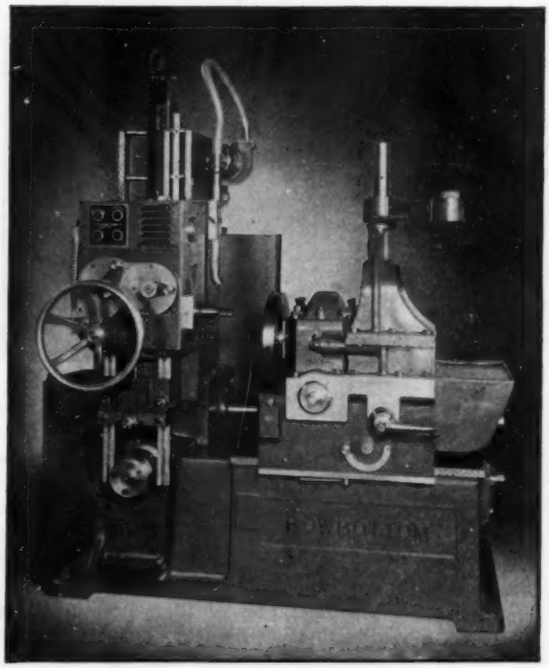
The Rowbottom cam milling machine, manufactured by the Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn., has been redesigned to increase its capacity without increasing the size of the machine. The bed casting has been reinforced to increase its rigidity and to lower the center of gravity of the machine. All shafts operating at more than 5 r.p.m. are now fitted with ball bearings. Separate motors are provided for feed and cutter drives and are electrically interlocked. The reversing of both the feed and the cutter motors is accomplished electrically rather than mechanically as in previous models.

While the new machine is an improvement over previous models, formers from all previous models can be used. The capacity of the machine has been increased from 28 to 32 in. diameter for box and face cams and from 24 to 30 in. diameter for barrel cams with a travel, or throw, up to 12 in. Larger sizes can be handled by special fixtures.

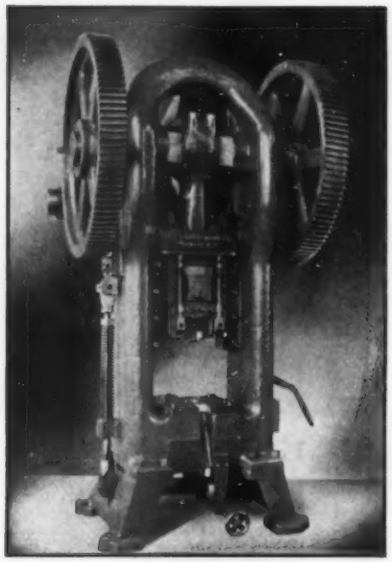
The machine occupies a floor space of 60 x 80 in., is 7 ft. high and weighs about 6,200 lb. The cutter spindle is mounted in Timken roller bearings and has eight speeds ranging from 66 to 500 r.p.m. Reverse speeds for left-hand cutters are controlled by the motor reversing switch.

The workhead is adapted to either barrel or face and box cams by rotating on trunnions to bring the axis of the work spindle either in a vertical or horizontal position. A shearing pin is inserted ahead of the gear train to save the gears from breakage through accident or overload. The workhead is moved to and from the cutter by a crank handle equipped with micrometer dial for correctly setting the depth of the cut.

The cam grinding attachment is now mounted above the cutter spindle with power take off directly from the cutter spindle motor instead of from a separate motor as used in the previous design. A cutting lubricant system is provided.



Design improvements permit increased capacity and give more rigidity in this Rowbottom cam milling machine



Z & H 200-Ton Straight-Side Press

The Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J., is offering a 200-ton capacity straight-side press in which the frame and pitman are solid steel castings. A wedge adjustment is provided for the slide to insure accuracy. The crankshaft bearings are bronze bushed and the back-gear shaft runs in heavy-duty roller bearings.

The standard stroke of the press is 4 in., but the press can be furnished with strokes up to 12 in. The distance between pillars is 25 in., bed area is 22 x 22 in., net weight is 10 tons. A 10-hp. motor is required.

Calorized Tubes

Calorized 1½ per cent molybdenum tubes, as offered by The Calorizing Co., Wilkinsburg Station, Pittsburgh, Pa., are said not to become brittle at any temperature and not to air harden appreciably. When used for chemical piping, the walls, inside and out, are alloyed with 35 per cent aluminum to a depth of 3/32 in. to provide oxidation and corrosion resistance. They may be expanded and may be bent hot on large radii, but they cannot be otherwise hot worked. The tough, calorized layer will stretch about 5 per cent before cracking. Tubes are grain refined after calorizing to 163 max. Brinell and 25 per cent minimum elongation. The high creep strength of these tubes makes them adaptable to high temperature chemical applications and for use as for roller conveyor rollers for furnaces under 1,400 F. The metal is also available for bolts and other furnace parts.

Lovejoy Type WF Flexible Coupling

The Lovejoy Tool Works, 4956 W. Lake St., Chicago, Ill., has introduced the Type WF flexible coupling in which one of the coupling bodies is made in the form of a flange which bolts on to the flywheel, or clutch or brake-drum of the engine. The flange-body design reduces the over-all length of this coupling by one-third. Coupling is made in sizes from 3 to 14 in. bores suitable for 2,500 hp. at 100 r.p.m. L-R Type W free-floating load cushions are used and are held in place by a quickly removable outside retaining spring. These load cushions are available in three types of resilient material.

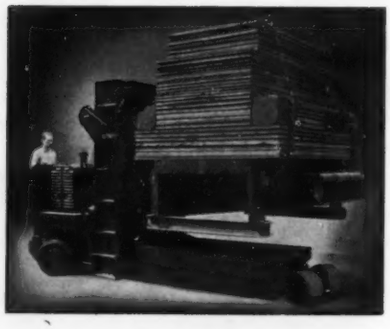
Whitney Notching Tool for Sheet Metal

The Whitney Metal Tool Co., 105 Mill St., Rockford, Ill., is now marketing a hand notching tool for use in fabricating sheet-metal parts. It is de-

signed for cutting beaded corners, notching the edges of curved seams and similar work. Dies are made of two pieces of hardened tool steel. Clearance is provided so that punchings will drop through the dies. A depth gage is mounted on the right side of the die. This gage is reversible so that any depth of notch can be cut without the gage projecting beyond the end of the die. A strong return spring is mounted between the forged steel handles.

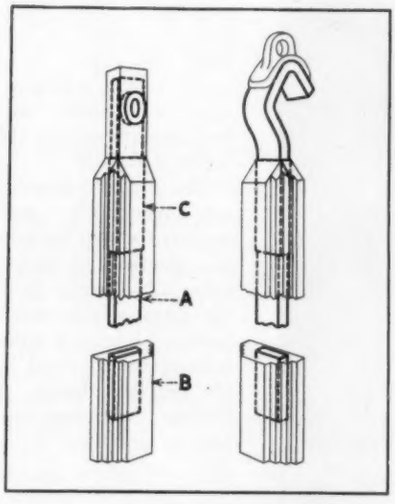
Automatic TLN-30 Industrial Truck

This "Automatic" Model TLN-30 industrial truck was designed and built by Automatic Transportation Co., 101 West 87th St., Chicago, Ill., for the safe handling of large 30-ton dies to and from the presses and storage racks. The lift platform permits handling the large dies with a minimum of time and labor. The truck is shown with a test load of large plates.



Crown Parallel-Step Chrome Anode

The Crown Rheostat & Supply Co., 1910 Maypole Ave., Chicago, Ill., is distributing a parallel-step anode for chrome plating. This anode features a copper core for uniform current distribution, and a stepped lead surface that is self cleaning and will not burn off at the solution line. It is claimed that the thickness of plate deposited is uniform for the entire length of the anode.



Features of the chrome anode are the copper core A, the lead sheath B, and the insulation C between core and sheath above and below the solution line to prevent excessive surface currents

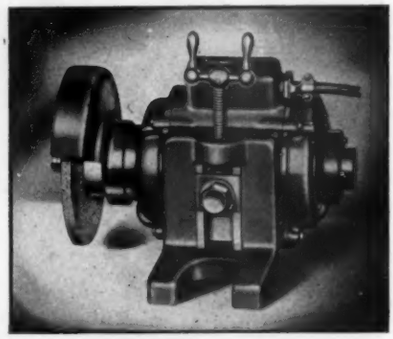
"Landmatic" Special 6-In. Diehead

The Landis Machine Co., Waynesboro, Pa., is marketing a special heavy-duty "Landmatic" diehead for large diameters, steep tapers and coarse pitches. This tool is primarily designed for cutting 6-in. O.D. thread, 4 pitch, 2-in. taper per foot and 5 in. length of thread. The same head can be adapted for cutting other diameters, tapers and thread lengths.

This stationary type head is adapted for use on a heavy-duty turret lathe. It is of the six-chaser type and is suitable for threading parts used in the oil industry, such as tool joints and drill stems. Thread length adjustment limits forward travel of the cam carrier and insures uniform threads.

"Hisey" Angle-Plate Grinding Attachment

The "Hisey" motor-driven angle-plate grinders are designed to be attached to the tool-post of a lathe, the vise of a milling machine or the head of



a planer or boring mill. They are manufactured by The Hisey-Wolf Machine Co., Cincinnati, Ohio, and are available in six sizes, ranging from ¼- to 5-hp. capacity. Commutating-type repulsion-induction motors are used for single-phase service. Double lock nuts are used on the spindle, permitting operation of the wheel in either direction with safety. This machine is equipped with ball bearings.

Chambersburg 100-Ton Hydraulic Cupping and Drawing Press

This 100-ton hydraulic, vertical cupping and drawing press has been especially designed by the Chambersburg Engineering Co., Chambersburg, Pa., to meet rigid customer specifications. The design is such that modifications to meet special requirements can easily be made.

With a press capacity of 100 tons and a pushback or stripping capacity of 14 tons, the press has a maximum stroke of 80 in. and a maximum depth of draw, length of stroke under load, of 37 in. The bed of the press is 24 x 24½ in. and the top of the press bed is 33½ in. above the floor. The bed is counterbored to accommodate the die holder. Four adjustable gibs guide the slide in the housing and a shoulder cap on the slide holds the punch during the stripping operation. Slide dimensions are 20 x 20 in. and the distance between gibs is 20½ in.

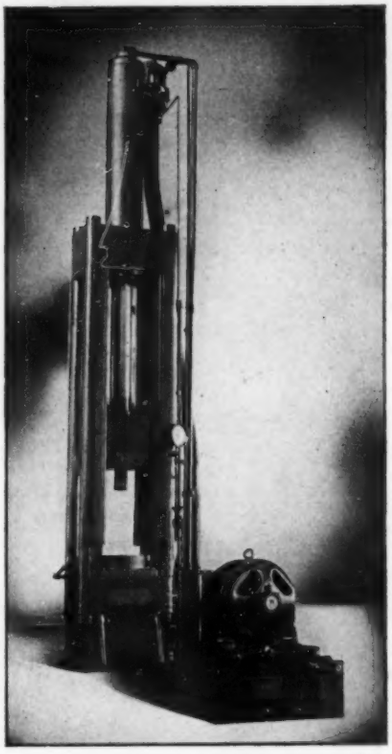
An approach speed of 175 ft. per min. is provided by the 3½-in. diameter quick-advance ram which telescopes inside the main ram. Approach speed is automatically reduced to the normal drawing speed of 25 to 27 ft. per min. just before the punch starts the drawing operation. Location of the trip for this change of speed is adjustable over a length of 40 in., measured from the bottom of the press stroke. Speed change is accomplished independently of the pressure in the quick advance cylinder.

The four-piece frame is assembled with four 3½-in. diameter shrunken tie rods. Over-all height of the press is 250 in. and the total weight is approximately 29,000 lb.

An automatic control unit actuates the press cycle and allows the press to descend any predetermined distance and automatically return, independent of pressure. An emergency push button is provided for reverse at any point of the working stroke when operating under automatic control. Provision is made for adjusting any portion of the automatic cycle to suit operating requirements. A hand control lever permits inching the ram when setting dies.

The motor, pump and tank unit is separate from the press, being connected to it only by pipes. Pump stroke variation permits press operation down to 10 per cent of maximum speed. An auxiliary 20 g.p.m. pump with suction strainer and a sump tank is provided for the drawing compound.

All controls are within easy reach



and safety devices fully protect the operator from possible injury. Automatic lubrication is provided for all working parts.

Sicromo Steels

A series of steels for high-temperature applications, to be known as Sicromo 1, 2, 3 and 5, has been developed by the Timken Steel & Tube Company, Canton, Ohio. Sicromo steels contain the 0.50 per cent molybdenum which has been found to be most effective for increasing creep strength on an economic basis. Their high silicon content develops the desired degree of oxidation resistance while economic resistance to corrosion is assured by the varying percentages of chromium indicated by the numbers.

Produced in electric furnaces under chemical and metallurgical control, these steels are designed to aid in the economic solution of high-temperature tubing problems. Sicromo 1, 2, and 3 are particularly suitable for use in high-temperature applications where low to medium oxidation and corrosion resistance is required. Sicromo 5 is designed for use where severe corrosion and oxidation are encountered.

Baker-Raulang Elevating Trucks

The Baker-Raulang Company, Cleveland, Ohio, has announced a complete line of gasoline-powered elevating platform trucks in capacities of 3, 4 and 5 tons. All trucks have a maximum speed of 10 m.p.h. but are governed to 7½ m.p.h. when they leave the factory. The 3-ton truck, with a standard 55 in. platform, has an over-all length of 115½ in., an outside turning radius of 99 in. and will make a right-angle turn in 106 in. intersecting aisles while carrying a loaded skid 36 in. wide by 60 in. long. The 4- and 5-ton trucks have an over-all length of 117⅜ in., outside turning radius of 107½ in. and will turn in 111-in. intersecting aisles with the 36x60-in. skid. A 46½-hp. Hercules Type IXB engine is used.

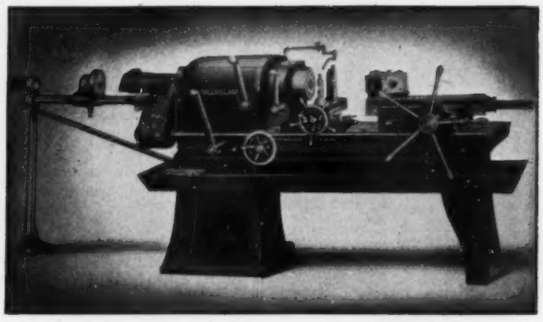
Grobet High-Speed Small Flat Drills

Available in diameters ranging from 0.002 to 0.100 in., a line of small flat drills made from high-speed steel has been announced by Grobet File Corp. of America, 3 Park Place, New York, N. Y. They are guaranteed to be accurate as to dimension and to be accurately centered.

Millholland No. 4H Turret Lathe

The No. 4H turret lathe, announced by Millholland Sales & Machine Co., 1115 East 35th St., Indianapolis, Ind., is designed for securing maximum production from all classes of material with the latest developments in cutting tools. The headstock has twelve speeds, forward and reverse, ranging from 39 to 1,000 r.p.m. Only two levers are used in starting, stopping, reversing and changing speeds. These machines will swing 16½ in. over the ways and 7¼ in. over the cross slide. The twelve feeds range from 0.005 to 0.136 in. Automatic chuck capacity is 1⅝ in. round stock, 1⅜ in. hexagon stock and 1¼ in. square stock. A length of 9½ in. can be turned.

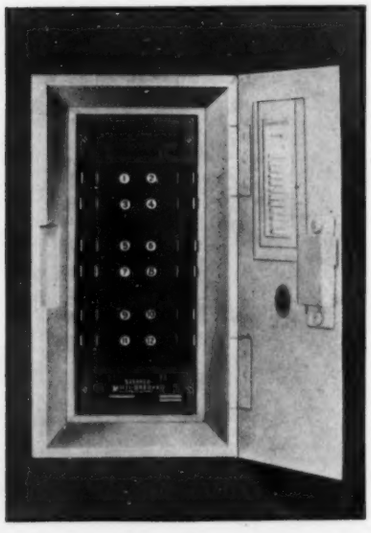
These machines can be fitted with either an automatic chuck and bar feed or a 10½-in. geared scroll chuck. Power cross feeds, turning attachments, compound tool slides and special tools are available.



Square D Panelboard

A line of "Multi-breakeR" lighting panelboards is announced by the Square D Co., Detroit, Mich. Of compact design and small size, boxes are 15-in. wide and 4-in. deep. These units can be mounted in locations not previously suitable for panelboards. Boxes are galvanized, have knockouts in top and bottom and are furnished trimmed in brown and tan colors with chromium-plated exterior hardware. Wiring gutters are 4-in. wide.

These panelboards are supplied with from four to 40 circuits in two circuit groupings for 115, 115/230 volt a.c. service. Mains can be arranged for either single-phase, 3-wire, solid neutral or 3-phase, 4-wire systems. Single pole (2- wire, solid neutral) branches are obtainable for 15, 20, 25 or 50 amp.



Calite BL-28 Annealing Box

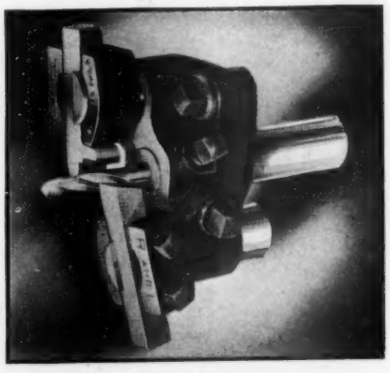
Designed for carrying forgings and castings through a roller-rail type annealing furnace, these annealing boxes or trays are offered by The Calorizing Co., Wilkinsburg Station, Pittsburgh, Pa. The sides, ends and bottoms are separate castings of Calite BL-28 alloy interlocked with angle section pins inserted in stake-like pockets in the corners. This sectional construction allows for expansion under uneven temperature conditions. The sides and bottom are corrugated with rectangular sections to give added strength.

The 24x36x11-in. box illustrated can carry two roller rails under the 36 in. side. The sides and ends are ¼ in. thick and the bottom is $\frac{5}{16}$ in. thick. Larger boxes can have perforated sides and bottom. The high creep-strength of Calite BL-28 make it particularly adaptable for use in these boxes.

R & L Turning Tool

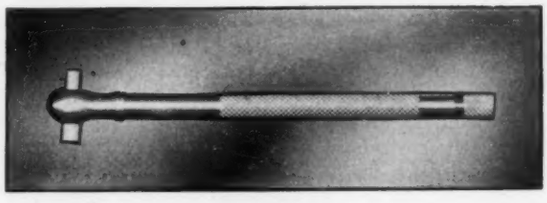
A small-size R & L combination turning tool, for use with No. 00 Brown & Sharpe automatic screw machines, is announced by R & L Tools, Nicetown, Philadelphia, Pa. This tool is identical with its larger counterparts, except for size and capacity.

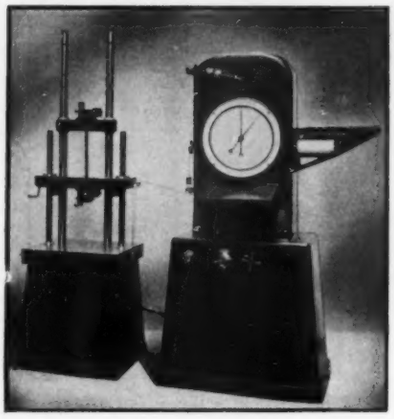
The tool body has a ⅝-in. diameter shank 1½ in. long. A ⅜-in. hole is bored in the shank. It will turn up to ½ in. diameter by 1¼ in. long and may be used for either right or left turning. This tool can also be used as a balanced tool with two cutters for roughing, for turning two or more diameters simultaneously, or as a combination tool for drilling or centering one or more diameters.



Lufkin No. 79AA Telescoping Gage

The No. 79AA telescoping gage manufactured by The Lufkin Rule Co., Saginaw, Mich., has a range from $\frac{5}{16}$ to ½ in. As in the larger gages of this type, the handle of this gage can be locked in the center of the plungers. The gage consists of a knurled handle and two plungers, one telescoping into the other and both under constant spring tension. Several sets of gages including this instrument are also offered, the most complete set consisting of six gages.





Tinius Olsen Testing Machines

The Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., is manufacturing the hydraulic universal testing machine illustrated in capacities from 20,000 to 200,000 lb. This unit weighs the load on a self-indicating pendulum dial from a packless cylinder. The load is applied to the specimen by hydraulic means from a pump housed in the cabinet below the pendulum dial. This actuates the piston and in turn applies stress to the specimen. The load is measured from the same cylinder. Full, half, one-fifth and one-tenth capacity ranges are usually furnished on these machines.

The self-indicating pendulum dial weighs the load by movement of the pointer over the dial face. The dial is uniformly graduated to give a straight line calibration over its entire range. For recording the stress-strain diagram an autographic attachment is mounted to the right of the pendulum dial. The recorder shown is furnished with a magnification of 10 to 1 for obtaining this diagram. When higher magnification is required, the electronic recorder is recommended as additional equipment. All charts are made on rectangular cross-section paper, on an 8½x11 in. letter-size sheet.

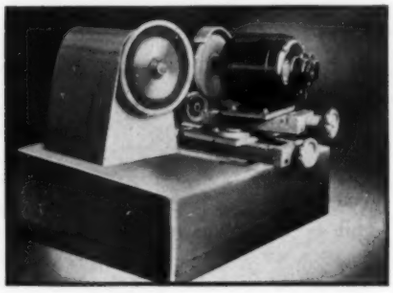
The lower crosshead may be either hand operated or motorized, depending on customer's requirement. Ample protection against dust and dirt is provided for the weighing system.

Rogers Circular Knife Grinder

Made in two sizes, the circular knife grinder announced by Samuel C. Rogers & Co., 191 Dutton Ave., Buffalo, N. Y., will sharpen single- or double-bevel knives or disks. The No. CC-1 unit will grind knives to 14 in. diameter and the No. CC-2 machine will grind up to 20 in. diameter. The units are entirely self-contained and are available in bench and floor types.

Knives are revolved by separate motor drive through V-belt connection. The knife is mounted on an adjustable arbor with provision for solid circular knives or knives made in two sections. For thin knives of small diameter, flanges are used to support the knife.

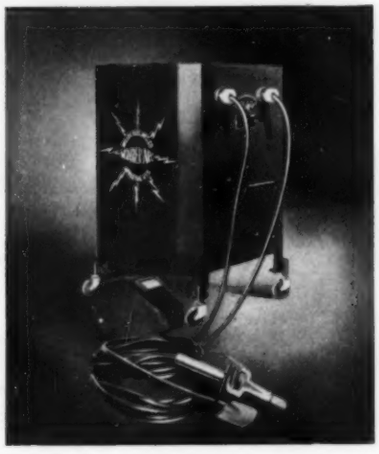
The 6 x ½-in. grinding wheel is mounted directly on the arbor of a ¼-hp. motor, and this in turn is mounted on a double adjustable slide.



This adjustable slide is graduated for setting to any degree of bevel. A swivel adjustment permits grinding bevels either way. The grinding head is operated by hand feed.

Miller "Wonder Arc" Portable Welder

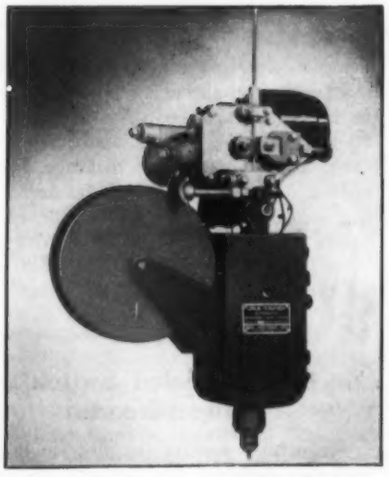
The Miller Electric Mfg. Co., Appleton, Wis., is offering a portable a.c. welder under the trade name "Wonder Arc." These units are of a special transformer type with capacities ranging from 125 to 600 amp. and are designed for use with 220 volt, 60 cycle, single-phase supply. Features include high power-factor characteristic, reactance control, static high-frequency arc and a sheet-metal attachment that permits welding light-gage metals.



Operating safety is assured as there are no electrical connections to be changed between the power input and the welding leads. Amperage control is provided by a rotating knife switch. These machines can be used for welding on grounded systems and for thawing frozen water pipes.

Automatic Taper For Una Welding Head

The Una all-electric type automatic arc welding head, with automatic taping attachment was introduced at the 1936 National Metal Exposition by Una Welding, Inc., 1615 Collamer Ave., Cleveland, Ohio. This Unamatic unit automatically feeds electrode wire from a 150- to 200-lb. reel and also automatically maintains the proper arc voltage. As the head feeds the wire down through the taper unit a separate tape is completely formed around the wire just ahead of the arc. This tape adds the necessary coating to the partially coated electrode to produce shielded arc weld metal. Due to the use of a continuous reel of electrode metal, stub end loss is eliminated and the welding can be made continuous. Higher welding heat can be used as the welding current enters the rod just ahead of the point where the tape is formed around the wire.

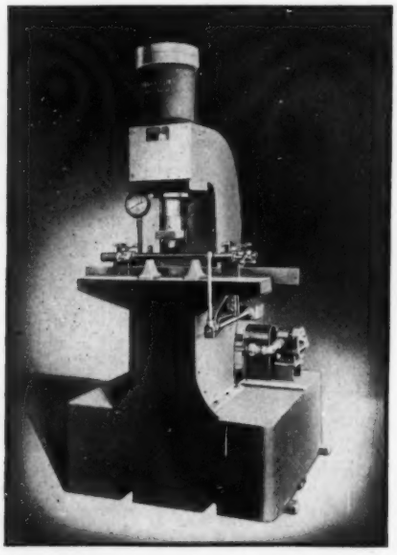


Durez No. 1547 Black

Durez No. 1547 Black, announced by General Plastics Inc., North Tonawanda, N. Y., is a plastic material for high impact-strength moldings. This material has an impact strength of 0.5 according to A.S.T.M. rating. It has a weight of 22.4 g. per cu.in. Moldings of this material can be machined and sanded and subsequently buffed back to the normal luster.

Hannifin 20-Ton Straightening Press

Designed for accurate straightening operations, this 20-ton hydraulic straightening press is offered by the Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago, Ill. The control mechanism permits operation of the ram

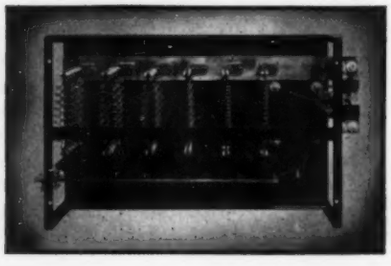


from a single lever, with a sensitive proportional control action. Slight, accurate ram movements, either up or down, may be obtained.

The hydraulic power unit is built into the base of the press, making the press a self-contained machine. Specifications are: Pressure, 20 tons; ram stroke, 6 in.; speed of power stroke, 69 in. per min.; speed of return stroke, 96 in. per min.; maximum distance of table to ram, 8½ in.; distance from center of ram to face of frame, 7½ in.; length of table, 36 in.; floor to table, 40 in.; over-all height, 6 ft. 9 in. A variety of fixtures are available for all types of straightening operations.

Crown Sealed Switch Plating Rheostat

Rheostats having totally inclosed switches designed for use with electroplating equipment have been announced by Crown Rheostat & Supply



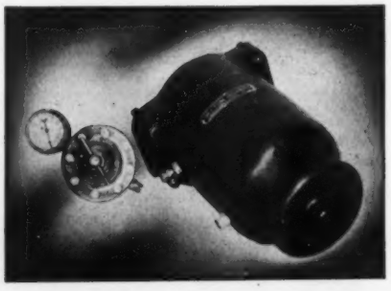
Co., 1910 Maypole Ave., Chicago, Ill. All contacts of these switches are inside sealed tubes protected from fumes and corrosion. Contacts are of heavier section than those previously used. When closed, these contacts are held together under pressure. Automatic adjustment is provided to compensate for contact wear.

Crown rheostats are made in sizes from 15 to 5,000 amp. and in several types. They are suitable for voltage control at the generator and for current control at the plating tank.

Dayton Rogers Pneumatic Die Cushion

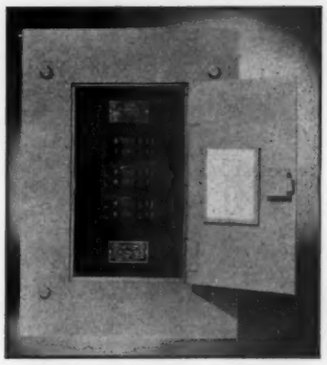
An improved design of combination drawing and stripping die cushion is now being marketed by the Dayton Rogers Mfg. Co., 1845 E. Franklin Ave., Minneapolis, Minn. Each cushion unit is self-contained and consists of its own air chamber which takes the air directly from the supply line. Auxiliary air tanks are not necessary. Provision is made for a pneumatic hose connection from the regulating valve with a pressure gage recording the amount of air pressure used on each job.

These units are compactly designed for easy installation on the bottom side of the bolster plate through the hole in the bed of the punch press. Rigid and accurate alignment is assured for both drawing and compound blanking and piercing operations. Five sizes are available, with piston diameters ranging from 4 to 12 in. and working pressures from ¼ to 5 tons on an air line pressure of 20 to 150 lb. Maximum drawing capacity is 1½ in. for all sizes.



W. E. & M. Co. "Nofuze" Panelboard

The "Nofuze" panelboard is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for general 115, 115/230 volt a.c. distribution with branch circuits ranging from 15

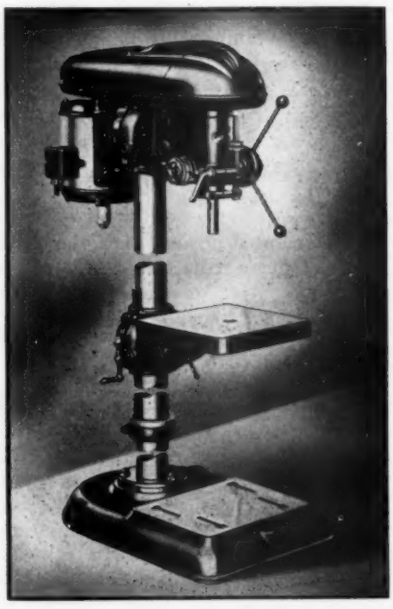


to 50 amp. capacity. This panelboard uses multi-breaker units recently developed to give load centers the advantages of circuit breaker protection. The units are available with four to 40 circuits in two circuit steps. Bus arrangements for single-phase, three-phase two-wire, and three-phase four-wire services can be provided.

Delta Column-Type Drill Presses

Avaliable with either a floor base or a bench-type base, these 17-in., column-type drill presses manufactured by the Delta Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis., have a 3½-in. column. Five spindle speeds are provided: 385, 600, 935, 1,450 and 2,240 r.p.m. The spindle pulley is of the floating type and no belt pull is transmitted to the spindle.

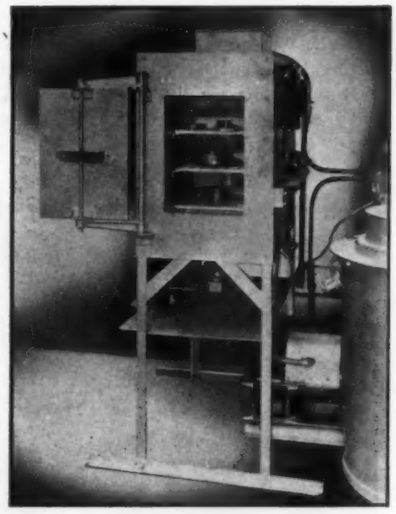
The floor base has a 10x13¾-in. table surface, slotted for T-bolts. A 11x12-in. tilting table or a 12½x17-in. production-type table is available for the floor-type models. The bench-type



models have a 20x20-in. table surface. Spindles are furnished either with a socket for No. 2 Morse taper or with a ½-in. Jacobs chuck. Maximum capacity of these machines is ¾ in. in cast iron. Machine heads can be used as units to build up special drilling machines.

Lindberg Toolroom Tempering Furnace

The Lindberg Engineering Co., 221 Union Park Court, Chicago, Ill., is manufacturing this box-type furnace for toolroom service. Construction is similar to that of other Cyclone furnaces designed for production heat-treating operations. In this furnace,

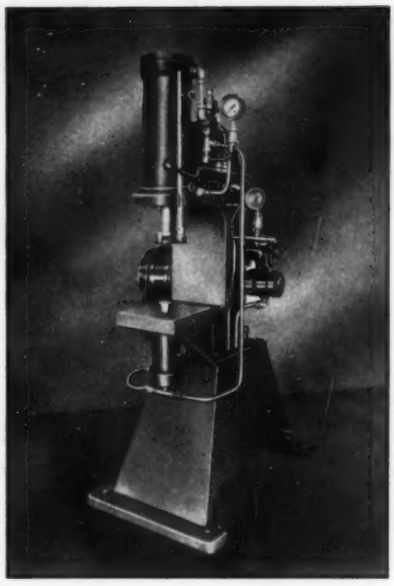


air is driven through electric heating elements by a blower fan. Heated air passes down through the charge and returns to the fan through a perforated metal bottom plate.

Several removable shelves are provided in the work chamber to hold small parts for tempering. The door is of the plug type and is specially hinged so that when opened the hot face of the door is away from the operator. These furnaces are available in several sizes, for application in tempering to 800 or 1,200 F.

Greenerd No. W60 Hydraulic Press

The No. W60 assembling, clamping and riveting hydraulic press announced by Edwin E. Bartlett Co., Nashua, N. H., features a second ram that operates through the working table and works in conjunction with the top ram. Operations of both rams are complete in one cycle. Valves for the two rams



are interconnected hydraulically. One control valve and lever operates the top piston. The bottom piston functions automatically in both directions.

Specifications: Working pressure, 15 tons; stroke of top ram, adjustable from 1 to 16 in.; stroke of bottom ram, 1½ in.; working table, 12x12 in.; height of table from floor, approximately 34 in.; over-all height, approximately 78 in. Four models are available, with working height over table ranging from 16 to 30 in. Net weight ranges from 2,000 to 2,300 lb. The hydraulic pump mounted on the back of the column is driven with a 3-hp. motor.

Alrose "Wite-Brass" Plating Process

The Alrose Chemical Company, Providence, R. I., is now marketing a "white brass" plating solution under the trade name "Wite-Brass." It is inexpensive to install and simple to control. A steel tank is used to hold the solution; this tank also serves as the plating anode. The bath operates at a temperature of 140 to 175 F. at a current density of 25 amp., per sq.ft. No after-buffing of plated work is required, a mirror finish is obtained on polished work when plated for as much as 2 hr. in a properly controlled solution.

Wite-Brass is an alloy plate of three metals that is claimed to be easier to maintain than an ordinary brass solution. Deposits are at the same rate as for an ordinary nickel solution. Its advantages are its silvery color, non-tarnishing properties and precious metal appearance. It can be plated over any metal surface and is suitable for all types of metal novelties, flat-ware, optical goods, reflectors, metal stampings; in fact, wherever nickel or silver is applied.

Signal Light-Duty Electric Drill

A light-duty, portable electric drill of ¼-in. capacity has been announced by Signal Electric Mfg. Co., Menominee, Mich. Designated as Model OB-8, this tool is designed for intermittent service. It is well balanced, has an air-cooled handle and a trigger-type switch and is equipped with 8 ft. of rubber-covered cord. Power is furnished by a universal motor for 110-120 volts d.c. or 25-60 cycle a.c. supply. The housing is of durable alloy steel. Speed at no-load is 2,950 r.p.m. Weight is 7 lb.

Murchey Double-End Threading Machine

A double-end, manually-operated threading machine with capacity for studs up to 39-in. long, is offered by Murchey Machine & Tool Co., 951 Porter St., Detroit, Mich. Hardened and ground spindles are mounted in pre-loaded roller bearings. The self-opening disheads, using tangential chasers, have live centers which aid in maintaining thread concentricity. Loading is done manually, the chuck being air operated.

Alemite Drive-Type Grease Fittings

Threaded drive fittings for high-pressure lubrication systems have been developed by the Alemite Division of Stewart-Warner Corp., 1826-1852 Diversary Parkway, Chicago, Ill. These fittings make their own threads when driven into $\frac{3}{8}$-in. holes. Tapping operations are eliminated. When it is necessary to replace one of these fittings, it is simply unscrewed from its position and a new one screwed into place.

At present there are four types of Alemite threaded drive fittings: Model 1720 is a straight fitting; 1721, a 30-deg. elbow; 1722, a 67½-deg. elbow; 1723, a 90-deg. elbow. All are cyanide hardened so that they can be applied to steel of 42 to 48 Rockwell hardness. They can also be applied to aluminum, aluminum alloys, malleable iron, steel castings and forgings.

The original application is accomplished with special drive tools. These drive tools are regularly supplied for use with a mallet, but they are available in styles suitable for use with air and electric hammers.

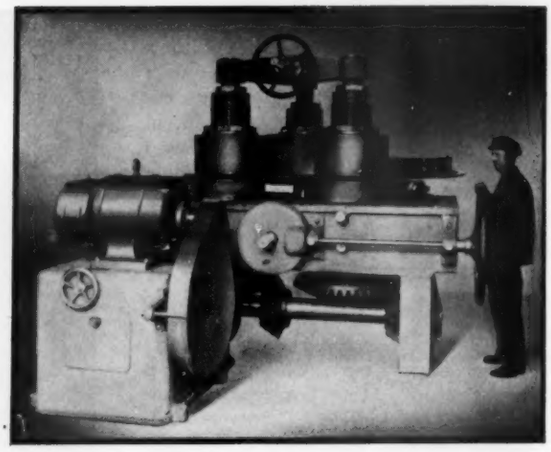
Ludlum Silchrome Stainless Steels

Ludlum Steel Co., Watervliet, N. Y., is changing the grade designations of part of its chrome-nickel Silcrome series so that in the future its stainless grades will be designated by numbers indicating as closely as possible their composition. Designations of grades not listed below remain unchanged.

Old Designation	*New Designation*
Silcrome KA2	Silcrome 18–8
Silcrome KA2–S	Silcrome 18–8–S
Silcrome KA2–T	Silcrome 18–8–T
Silcrome KA2–C	Silcrome 18–8–C
Silcrome KA2–MS	Silcrome 18–8–M
Silcrome KA2–EZ	Silcrome 18–8–EZ

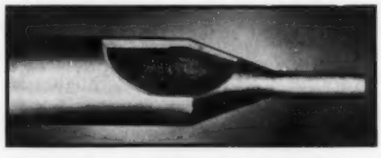
Schatz Angle-Bending Rolls

The Schatz Mfg. Co., Poughkeepsie, N. Y., is offering a line of "Schatz-Herkules" horizontal angle-bending rolls. These machines are available in five sizes with capacity for rolling 3, 4, 5, 6 and 8-in. angles. Roll design assures accurate rolling without twisting. Normally, two of the rolls are driven, but all three rolls can be positively driven when required to enable the machine to bend smaller than usual diameters. Operating speeds are 16 and 32 ft. per min. The unit illustrated is Size BO-34, having capacity to roll 8x8x1-in. angles, 18-in. beams, 8x1-in. flats and proportional sizes in other profiles, without the necessity of interchanging the rolls. This machine weighs 36,500 lb. and requires a 40-hp. reversible motor.



Calite Alloy BL-28 Furnace Rollers

Featuring a centrifugally cast body flash-welded to sand-cast neck and shaft ends, Calite Alloy BL-28 furnace rollers were exhibited at the 1936 Metal Show by The Calorizing Co., Wilkinsburg Station, Pittsburgh, Pa. The quality of the weld is illustrated in the cut-away roll-section shown in the accompanying photograph.



These rollers may be stressed to 2,000 lb. per sq.in. at 1,800 F. and 750 lb. per sq.in. at 2,000 F.

"Giant Grip Junior" Arc Welder

The Giant Grip Mfg. Co., Oshkosh, Wis., is offering a line of four a.c. welders, from 90 to 300 amp. capacity, to supplement their line of standard "Giant Grip" welders. Carrying the trade name "Giant Grip Junior," these welders are lighter in weight than the standard welders. Two of the models have ten amperage-control points and the other two have sixteen control points.

Each welder is equipped with a rotating knife switch with the amperage distinctly marked at each position. As they are not of the auto-transformer type, these welders can be used on grounded systems.

D-H-S Bronzes

Available for castings or forgings, D-H-S bronzes are offered in four grades by the Bartlett Hayward Div., Koppers Co., Baltimore, Md. High compressive strength, ductility, hardness, resistance to acids and ability to withstand wear and shocks is claimed for these alloys. They will not score contacting metals. These bronzes have a very fine and dense grain structure. The five constituent metals are uniformly distributed.

D-H-S BRONZE (Minimum Properties)

GRADE	NO. 1	NO. 2	NO. 3	NO. 4
Ultimate Tensile Strength (lbs. per sq. in.)	120,000	115,000	105,000	90,000
Yield Point (lbs. per sq. in.)	95,000	90,000	60,000	45,000
Elastic Limit (lbs. per sq. in.)	60,000	55,000	50,000	40,000
Elongation—per cent in two inches	12	12	17	25
Reduction of Area—per cent	12	12	17	25
Brinell Hardness No.	240	275	200	185
Weight—lbs. per cubic inch	.275	.278	.280	.285

Note: Recommended for applications where lineal contact speeds do not exceed 250 feet per minute.

The Round Table

TO THE LOWEST BIDDER?

"Quite a difference in these bids, Al. I was afraid that new fixture you wanted was going to cost us a lot of money."

"There's too big a difference, Ed. That Buckley bid doesn't sound right to me."

"I think it's a swell bid. The Sansom crowd must be trying to earn an extra dividend. If Buckley can make money on it for $300, that Sansom shop must think we're easy marks."

"That's the point, Ed. You know darned well that Buckley can't make a living wage at that price. You just said you thought it would cost a lot more."

"We should worry about that, Al. If he loses money, that's his funeral, not ours. You haven't turned philanthropist, have you?"

"Not that I know of, Ed. I'm not thinking so much of philanthropy, or of Buckley, as I am of ourselves. I don't believe we can afford to accept that low bid."

"Why not, for Pete's sake? Buckley's a good mechanic, and he ought to know what fixture work costs. Didn't he used to work for Sansom?"

"He worked for Sansom all right, Ed. And he knows how to make fixtures. He may know what they cost to make in the shop. But I'm dead sure he don't know much about other costs, such as overhead."

"What's that got to do with us, Al? Have we got to wet-nurse him till he cuts his eye teeth? If he loses money on our job he'll know better next time —or he'll fold up. But that's his lookout."

"There's another side to it, Ed. Our side, and Sansom's."

"Haven't any stock in Sansom's have you, Al?"

"Not a share, Ed. I'm all tied up here with you. That's why I don't think we can afford to deal with men who don't know their costs."

"But we save money while he's learning, don't we?"

"Maybe it might be expensive saving."

"I don't get you at all, Al."

"We're interested in a source of supply we can depend on when we need it. Sansom has always given us good

service at what I believe was a fair price. He gives no evidence of having made high profits."

"But what about our savings?"

"Just suppose half of Sansom's customers went to Buckley. Buckley loses money and finally folds up. In the meantime Sansom has been crippled and may even go on the rocks. Or he may go into some other line. Where do we get off when we really want good fixtures, and in a hurry?"

"Sounds kind of far-fetched to me, Al. This is a competitive age and the low man wins."

"Unless he's too low, and then everybody loses, Ed."

Is Ed right in favoring the low bid— or is Al's "long time" theory better?

DISCUSSION

One Foreman

The answer to the feasibility of one foreman taking care of two shifts in his department lies with the management and the foreman himself.

If the management is the type that trains foremen, who in turn train their workers to be efficient and self-reliant, then there is no reason why the foreman cannot delegate a competent man as his assistant, in charge nights, and there will be no trouble or buckpassing.

In most cases where trouble arises, it can be traced right back to management that does not hire the right kind of men for the position: men who fear

to train others, so that there will be no danger of another taking away their job; or men who, although they personally can do efficiently any job or operation under their control, cannot or have not the ability to teach and to imbue workers with a spirit of self-reliance.

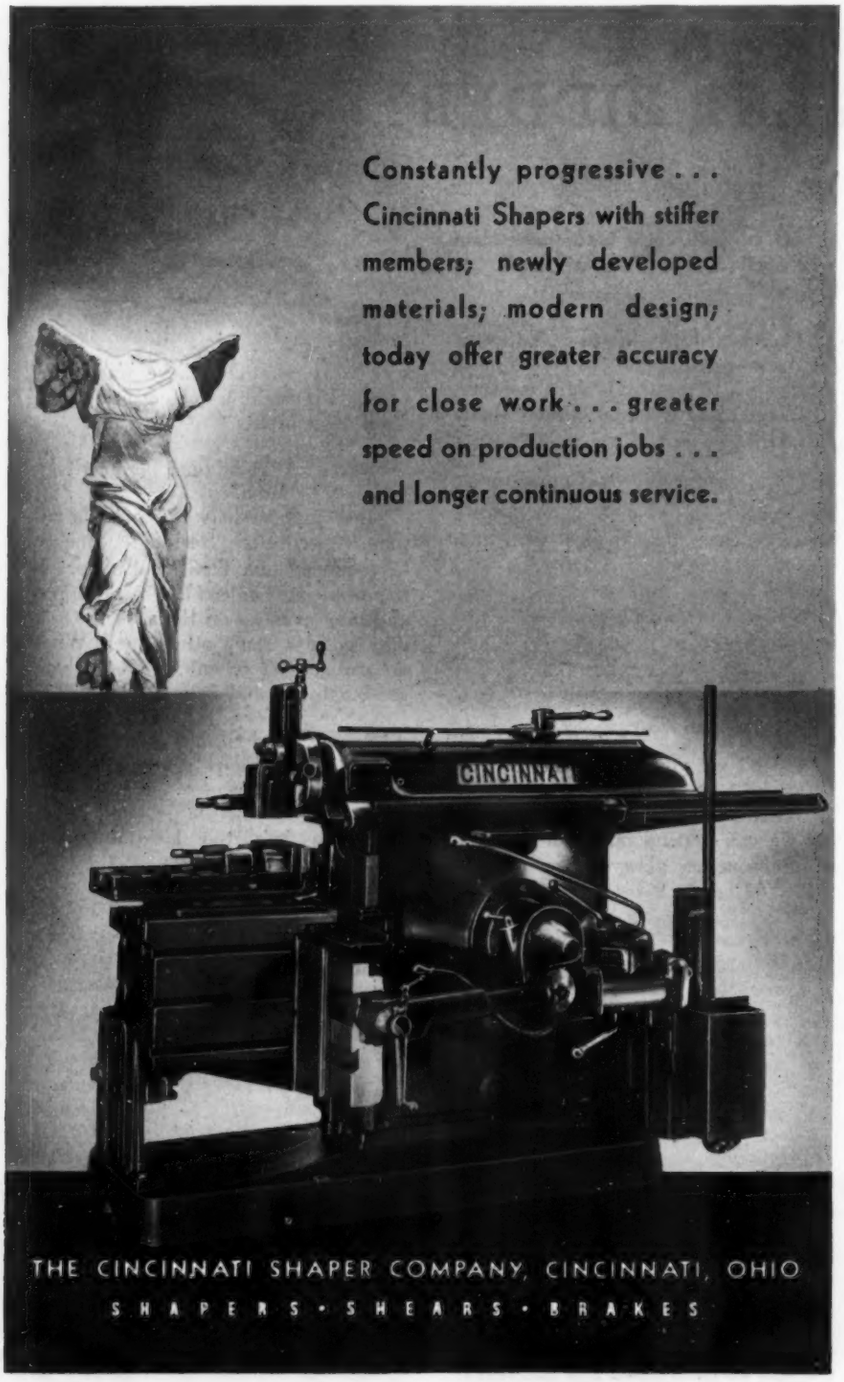
No plant that hopes to be successful can have a department head that is considered irreplaceable. When a department cannot run an extra shift without the foreman's presence, then look at the top of the organization for the trouble.

—Charles R. Whitehouse.

The idea of having one foreman responsible for both shifts is thoroughly practical, because I have seen it in successful operation at a time when production requirements were vitally important—during the late War. Then, as now, the essential factors in the success of the plan called for two men who had confidence in each other's ability, one to direct and the other faithfully to carry out his directions.

As I recall, the shop force consisted of 80 men working days. When increased orders made a night force necessary, the assistant foreman took over the night assignment, handling about 60 more men, mostly new hands leavened with a nucleus of old-timers. The day foreman planned and laid out the work and stayed about half an hour later than his usual quitting time in order to talk things over with his night subordinate. Thus, the night man's job consisted merely of routine supervision. When the night force was dispensed with, the assistant foreman went back to his day job, more of an asset to his company, his foreman and himself.

—Robert S. Alexander.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Bonuses for Toolmakers

I am strongly in accord with Ed's views in regard to toolmakers receiving a better rate rather than to introduce bonus systems. Probably the bonus systems that are in successful operation on production in many plants would be successful for toolmakers, if the rate fixing could be carried out in a proper manner. A bonus rate can be fixed by anyone, but to do it right and prove it is right requires an individual with special training and a wide experience in toolmaking. To fix rates for some of the complicated press tools would tax the ability of the very best rate fixers, it being practically impossible to see beforehand the difficulties that may arise. Hence, it is best to have good supervision in toolrooms, combined with the payment of good wages to good men. —A. Eyles,
St. Albans, Herts, England.

The firm, according to Ed, which divides the bonus into three parts and pays one-third if a certain time is kept in finishing the job, one-third if the tool will stand up for a fixed number of pieces between grinds, and the last third after the tool is worn out, will not succeed in applying the system. A bonus for the toolmaker will, of course, have the same effect as for the piece worker, but it should be paid promptly the week after finishing the job.

The manufacturer in question must be a small one where the toolmaker does all the work on the tools including hardening. Otherwise I can see no sense at all in dividing the bonus the way he does. Only a very small per-

centage of the tools finished today are made that way. If so, the system does not work for most of the toolmakers as their work is specialized just as much as in many other trades.

—A. E. Fristedt,
Stockholm, Sweden.

Rate Adjustment

Speed of working is definitely encouraged by bonuses, and for this reason it is more difficult to use them where the workers must be more than ordinarily accurate. Rates must be set to suit the special case of these special workers. The rate-fixer, and the management behind him, should understand, appreciate and allow for these particular conditions and requirements. In this connection, in different toolroom jobs there is much greater diversity, both in detail and intricacy, than may appear at first sight. The scheme should be elastic enough to permit of adjustment when conditions warrant. Here the toolroom chief should be allowed his say. A memo from him on an authorized form might answer the purpose.

—W. R. Needham,
Stafford, England.

Jam Threads

Jam threads can never be as efficient as cotter pins for preventing nuts from slacking back. The tightness is due to the difference in the angle of the threads. Threads mated together tend to wear one another to the same angle, and the tightness disappears after the nut has been undone a few times. Another objection is that the male and female threads do not make contact over their entire surfaces as with perfectly fitting threads. Therefore, local parts of the threads may be severely overloaded. This results in these parts spreading so that the difference in the angle is reduced. When tightness in any threaded connection is due only to local high spots, such connections are not to be relied upon even for moderately heavy loads.—W. E. Warner.

Good As New?

The question of whether a machine should be rebuilt or replaced is one of the vital elements in the economic planning of a production unit. As simple as it may appear, many officials sometimes confuse repairing with rebuilding and when these are distinguished from one another it usually produces a significent conclusion in respect to the replacement policy of a plant.

In certain forms of manufacturing, precision plus production are factors in successful competition. These cannot be achieved with the use of old equipment regardless of the condition it may be in.

Having had some experience in supervising departments comprised of specialized automatic machines, I have found that it is unsound to merely "doctor up" a worn, troublesome machine of this type in order to keep it running. It becomes a matter of either rebuilding or removing the machine from the production unit.

Rebuilding undoubtedly possesses advantages in many cases, but sometimes managements become so engrossed in this policy that they forget that new developments are constantly taking place in the machine-tool industry which justify replacing older equipment. —Peter L. Budwitz.

Apprenticeship on Japanese Government Railroads

The following information concerning the Japanese Government, Railway Systems' apprentice plan came to the Federal Committee on Apprentice Training from a personal interview with K. Yamaguchi, M. E., Assistant Manager of the Ohmiya Workshop, who is in charge of apprenticeship.

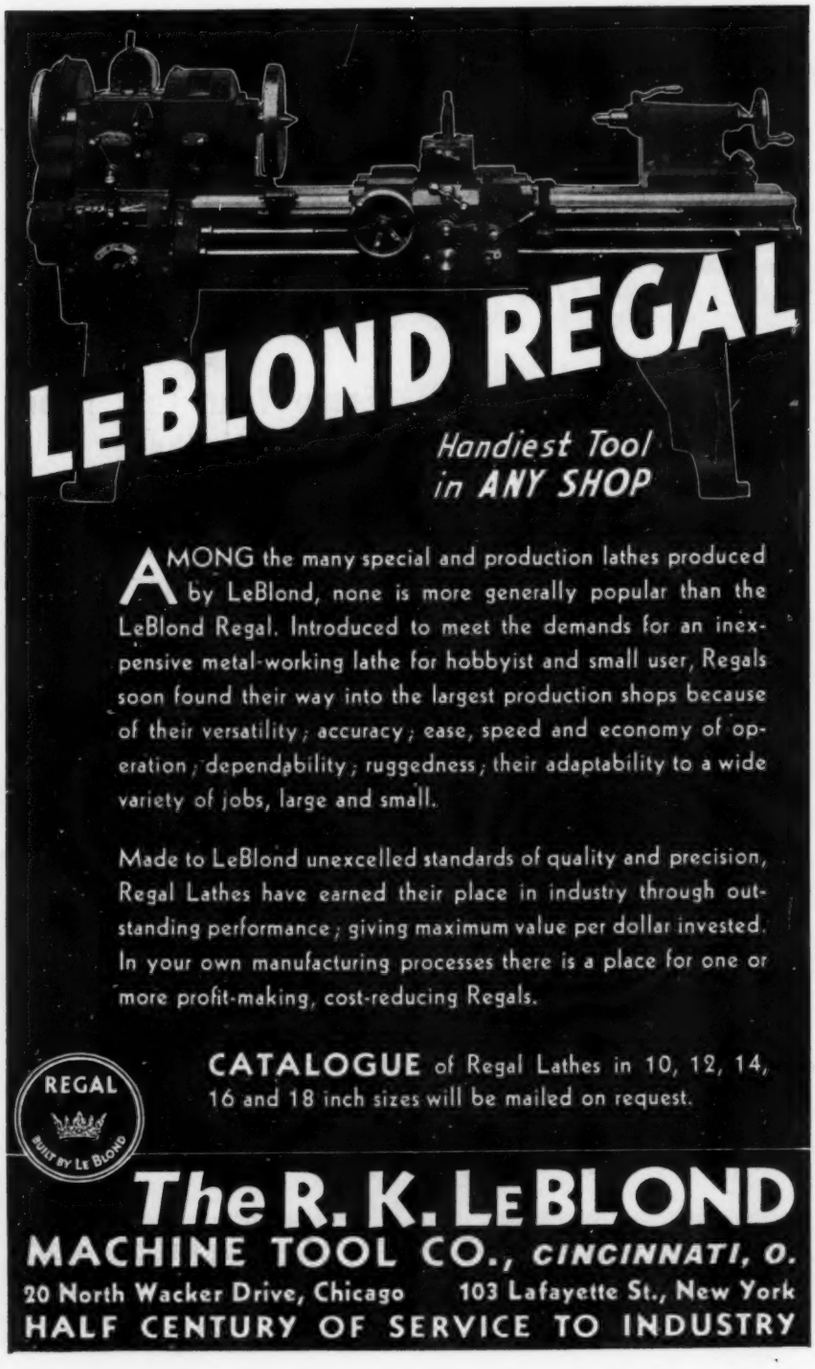
Selection of the apprentices is considered of primary importance. The fact that a youth's parent is an expert mechanic and may wish his son to follow in his own footsteps is no particular evidence that the son has any aptitude for that occupation. The fact that the youth himself may show a strong desire to enter into training for a particular craft is not considered sufficient evidence of his ability, for the youth may have an excellent aptitude for some other skill regarding which he knows nothing. There are many more applicants for apprenticeships than there are openings so the apprentices are first selected through competitive examinations covering elementary school subjects. The youths passing this test with the highest grades are then given a combination psychological and aptitude test which has been worked out with educational authorities. The purpose of this test is to eliminate the boys with the poorest chance for a successful career in the skilled manual occupations.

As soon as the boys are selected they are sent to a special railroad apprentice school for half a year where they are given a 20-day training in each of eight crafts. During this period the work of the apprentice is under careful observation by the instructors and foremen. Each makes a careful report of his observations. When the training period is over the reports are assembled and a decision is made as to which one of the eight crafts each boy is to specialize in. As soon as the selection is completed—this is done entirely from the performance reports—the apprentices are sent to the various shops where their job training is to be given.

During the job training the youths are required to take related school training from twelve to eighteen hours per week. Apprentices work an eight hour day and all classroom instruction is considered working time. The related instruction consists of such subjects as shop arithmetic, blue-print reading, sketching, materials, shop practice, and other subjects related to the trade being learned. Great care is given to the preparation of text materials in order to keep it up to date and accurate. Mr. Yamaguchi said that the selection and training of the foremen—most of whom are college trained—is one of their most important functions since the foremen are responsible for the skill-training of the apprentices.

Grinding in Railroad Shops

Grinding seems to be gaining favor in railroad shops, in principle as the diplomats say, if not in actual practice as yet. Rolling of axles and crankpins was being carried on in two shops recently visited but in both cases the men expressed a preference for grinding. The seed that has been sown by advocates of grinding may be getting ready to sprout.


LE BLOND REGAL
Handiest Tool in ANY SHOP
AMONG the many special and production lathes produced by LeBlond, none is more generally popular than the LeBlond Regal. Introduced to meet the demands for an inexpensive metal-working lathe for hobbyist and small user, Regals soon found their way into the largest production shops because of their versatility; accuracy; ease, speed and economy of operation; dependability; ruggedness; their adaptability to a wide variety of jobs, large and small.
Made to LeBlond unexcelled standards of quality and precision, Regal Lathes have earned their place in industry through outstanding performance; giving maximum value per dollar invested. In your own manufacturing processes there is a place for one or more profit-making, cost-reducing Regals.
REGAL
BUILT BY LE BLOND
CATALOGUE of Regal Lathes in 10, 12, 14, 16 and 18 inch sizes will be mailed on request.
The R. K. LE BLOND
MACHINE TOOL CO., CINCINNATI, O.
20 North Wacker Drive, Chicago 103 Lafayette St., New York
HALF CENTURY OF SERVICE TO INDUSTRY

American Machinist

December 30, 1936

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Volume 80 Number 27

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ANNUAL REVIEW & CATALOG NUMBER

COMING .... JANUARY 27

A directory of practically everything that a metal-working plant buys. It will help you all through 1937 in selecting machine tools, small tools, auxiliary equipment, materials, and supplies.

Typical Management and Production Executives Tell How Useful This Buying Reference Issue is . . . . . .

DOEHLER DIE CASTING CO.
"It will be passed around to all executives and will then be retained for reference purposes, in connection with specifications in the buying of equipment."
Vice-President

AMERICAN LOCOMOTIVE CO.
"This issue will be filed in our Engineering Department for reference purposes."
Manager

LALANCE & GROSJEAN CORP.
"The writer is holding it near his desk for reference as he finds opportunity."
Secretary

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"We plan to use it when occasion arises to purchase items described therein."
Treasurer

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"It will be of great service to us."
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HELLER BROTHERS CO.
"We find this catalog very useful."
Asst. General Manager

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"We find it very helpful."
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"We intend to use this in our plant purchasing department as an additional directory or buyer's guide."
Operating Superintendent

LONG MANUFACTURING CO.
"Our manufacturing and purchasing departments should be benefited by the assistance this catalog will give them in helping solve their equipment problems."
Secretary-treasurer

SAGER LOCK WORKS
"The Where-to-Buy Directory will undoubtedly be of much use to us in purchasing."
Assistant Works Manager

Typical Purchasing Agents also . . . . .

CHEVROLET-MUNCIE
(Division of General Motors Corp.)
"Information contained in it will prove to be of decided practical service to me throughout the year. Kindly place my name on the list for your 1937 edition."
Purchasing Agent

CADILLAC MOTOR CAR CO.
"We have turned this number over to our buyers of machinery and repair parts. We know it will prove to be very useful for reference."
Purchasing Department

HUDSON MOTOR CAR CO.
"This will find a useful place in our files, for reference as to various suppliers of machines and equipment."
Purchasing Agent

AMERICAN BRIDGE CO.
"I find this very helpful."
Purchasing Department

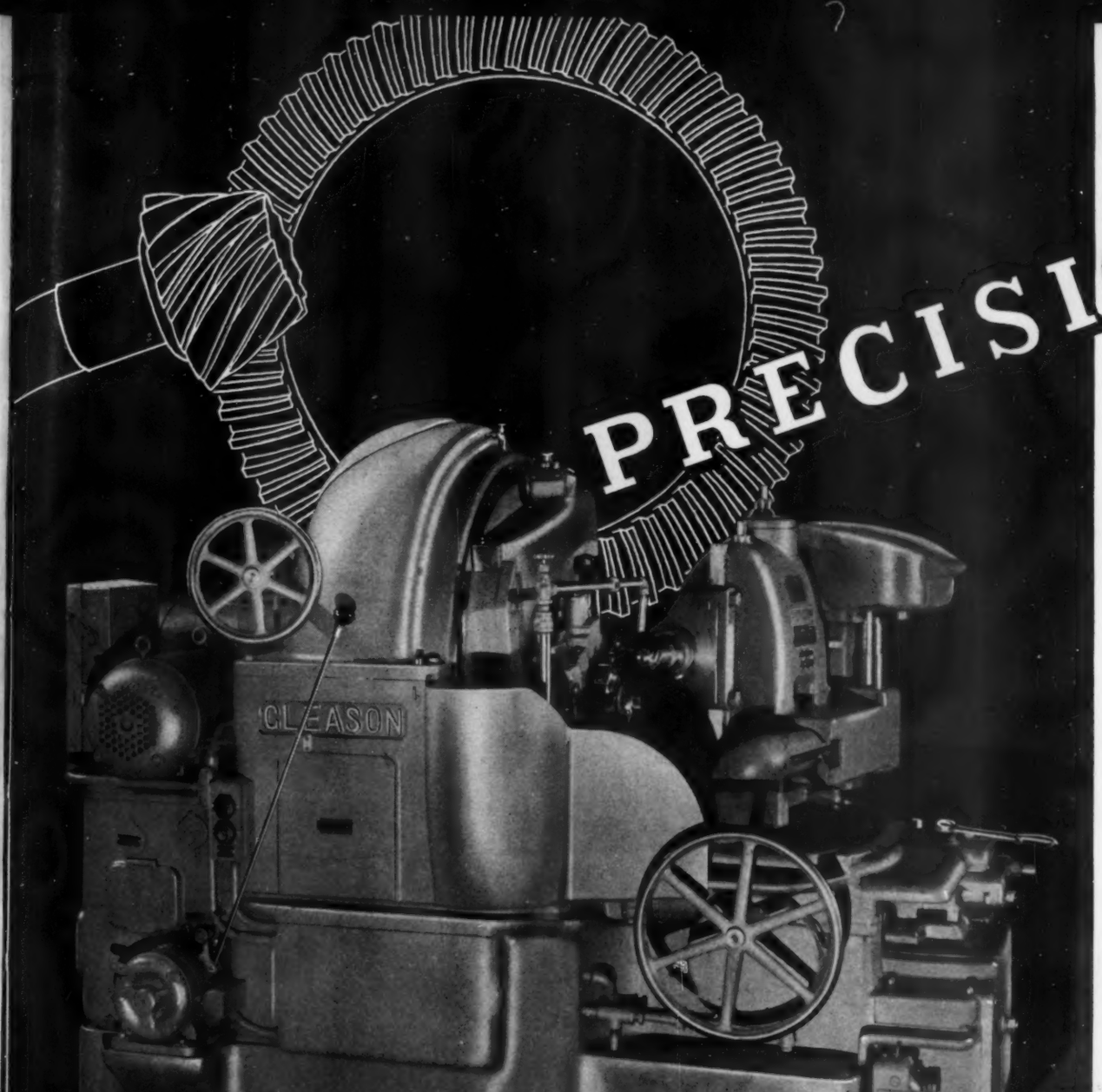
ANCHOR CAP & CLOSURE CORP.
"Our practice in the past has been to place publications of this type in the reference files of our Purchasing Department, so they are readily available throughout the year. We would like the 1937 edition, as we are certain that it will be helpful."
Purchasing Agent

INTERNATIONAL BUSINESS MACHINES CORP.
"We are placing this publication in our catalog file and will use same for reference purposes when the occasion arises."
Purchasing Agent

NATIONAL TRANSIT PUMP & MACHINE CO.
"We like it very much. It will be retained close at hand for future reference."
Purchasing Agent

GENERAL ELECTRIC CO.
(Bloomfield Plant)
"I am sure that reference to this magazine from time to time will be of great help to me."
Supervisor, Order and Service Department

AMERICAN STEEL FOUNDRIES
"We will be very glad if you will send us your 1937 number, as we believe that this magazine will be referred to a great many times during the year."
Supply Agent



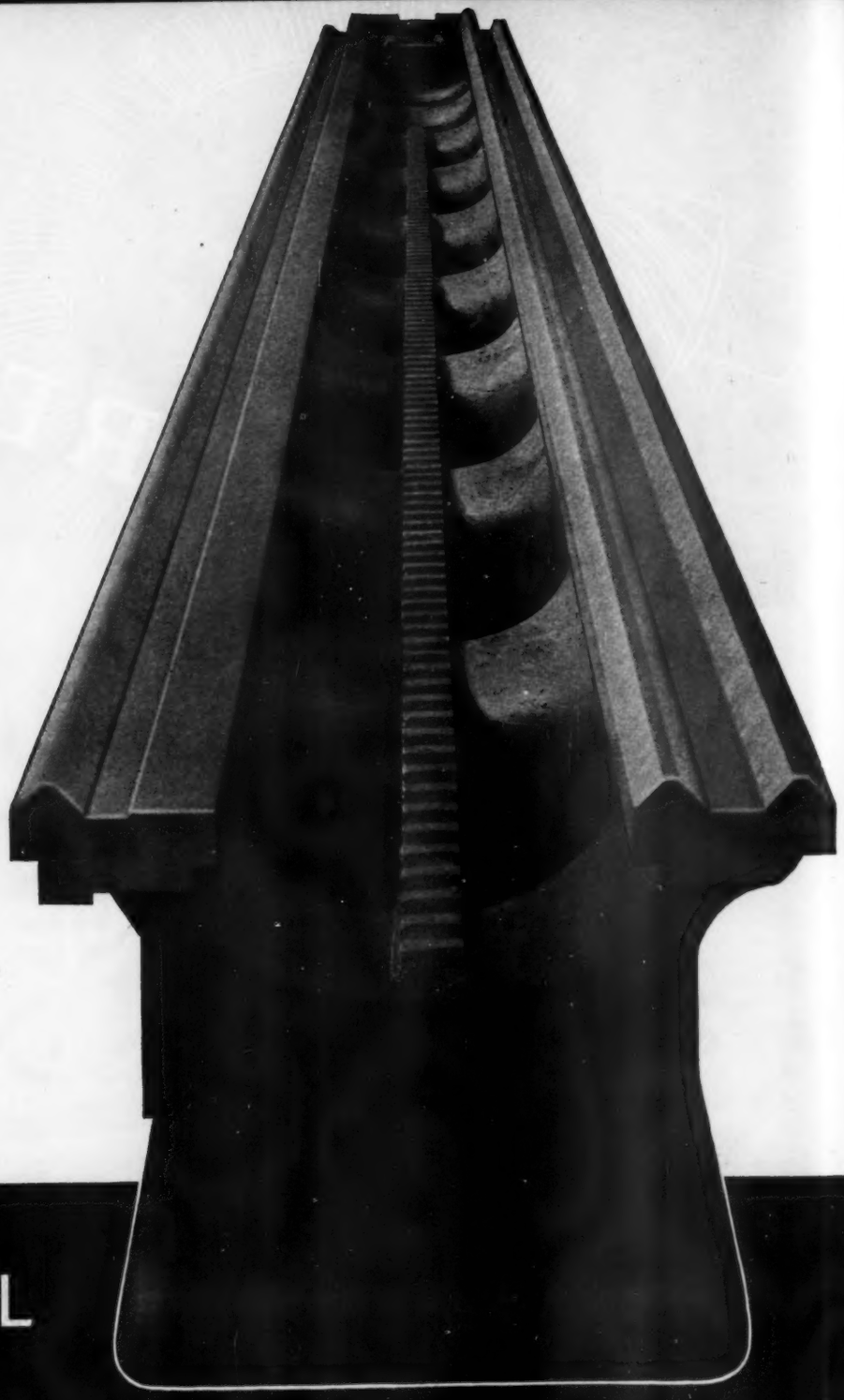
NUMBER 16 SPIRAL BEVEL AND HYPOID GENERATOR

● A massive rigid machine with precision reflected in every gear it generates . . . insures uniformity . . . cuts an exceptionally smooth tooth . . . flexibility of cutter settings minimizes cutter requirements . . . a new and simplified calculating system speeds the set up.

Capacity: 18" pitch diameter, 10 to 1 ratio, 2½ diametral pitch.

GLEASON

GLEASON WORKS • ROCHESTER, N.

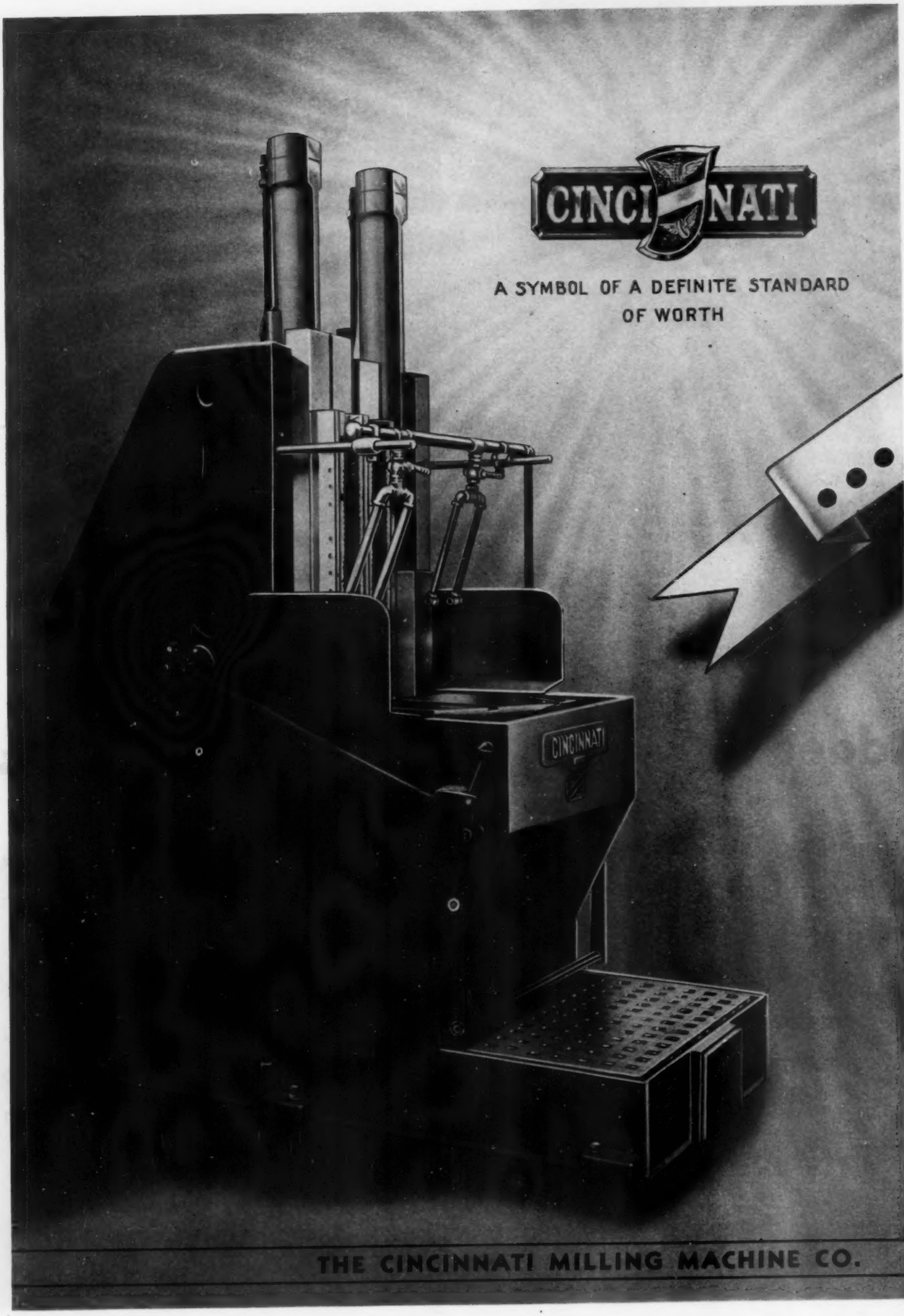


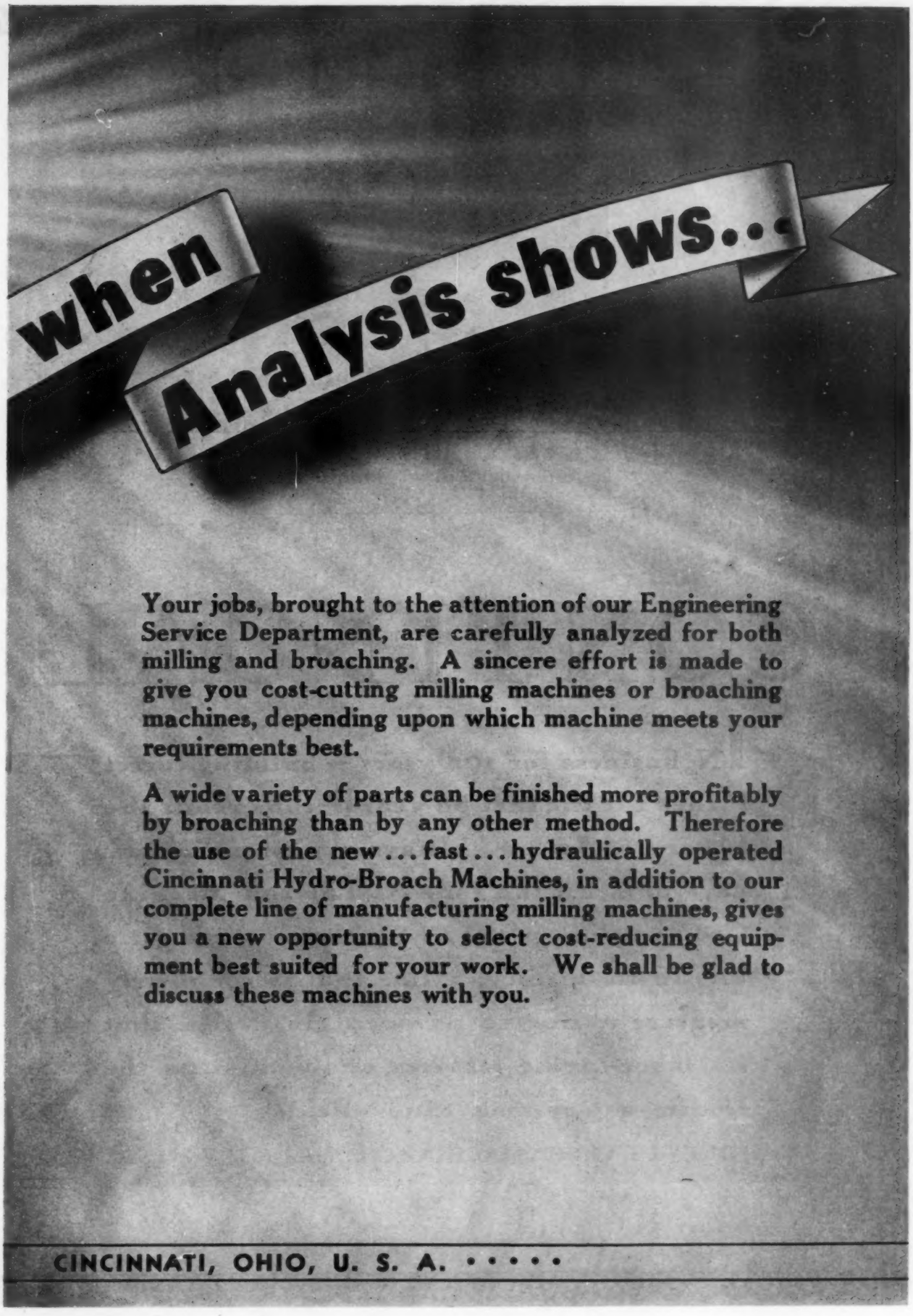
ELLIPTICAL GIRTHS FOR PERMANENT ACCURACY

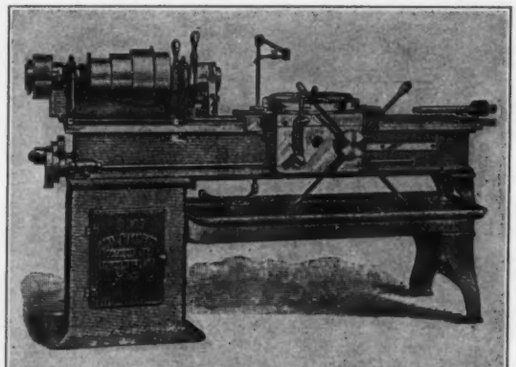
Added Strength - - - Added Profits

A rigid bed is the first requirement of an accurate lathe. Lodge & Shipley elliptical girth lathe beds produce a degree of strength and rigidity impossible with the conventional square girth design. That added strength means faster cutting speeds and greater metal removing possibilities without sacrifice of accuracy. You better than anyone else know what faster production means to your profits. Let us show you what Lodge & Shipley lathes can do for your production.

THE LODGE & SHIPLEY MACHINE TOOL CO.
CINCINNATI **OHIO, U. S. A.**


CINCINNATI
A SYMBOL OF A DEFINITE STANDARD
OF WORTH
CINCINNATI
THE CINCINNATI MILLING MACHINE CO.


when
Analysis shows...
Your jobs, brought to the attention of our Engineering Service Department, are carefully analyzed for both milling and broaching. A sincere effort is made to give you cost-cutting milling machines or broaching machines, depending upon which machine meets your requirements best.
A wide variety of parts can be finished more profitably by broaching than by any other method. Therefore the use of the new ... fast ... hydraulically operated Cincinnati Hydro-Broach Machines, in addition to our complete line of manufacturing milling machines, gives you a new opportunity to select cost-reducing equipment best suited for your work. We shall be glad to discuss these machines with you.
CINCINNATI, OHIO, U. S. A.



Jones & Lamson Machine Co.
SPRINGFIELD, VERMONT.
SOLE BUILDERS OF THE
FLAT TURRET LATHE,
And other Turret Machinery.
Send for Catalogue.

CONTINUAL

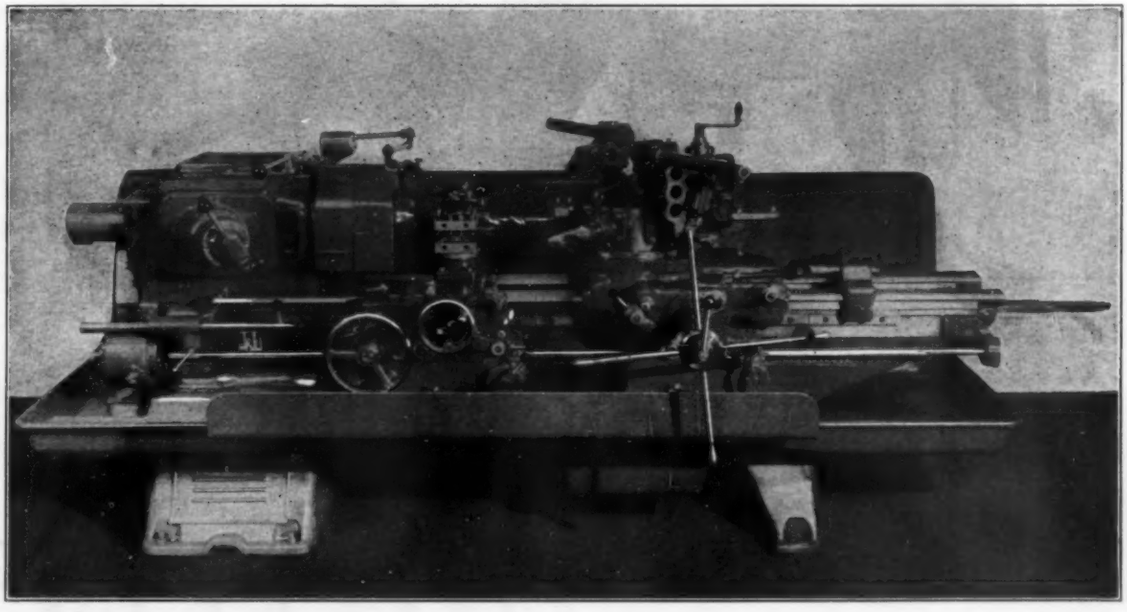
IN business for 102 years — building turret lathes for the last 88 years—thus reads the history of J&L. Always a pioneer in new development, the Jones & Lamson Machine Company enters 1937 with the most complete line in its history; a line that is completely modern; a line so advanced in design that its labor-saving features establish it as the leading money-maker in its field.

JONES & LAMSON MACHINE CO., Springfield, Vt., U.S.A.

1835

1937

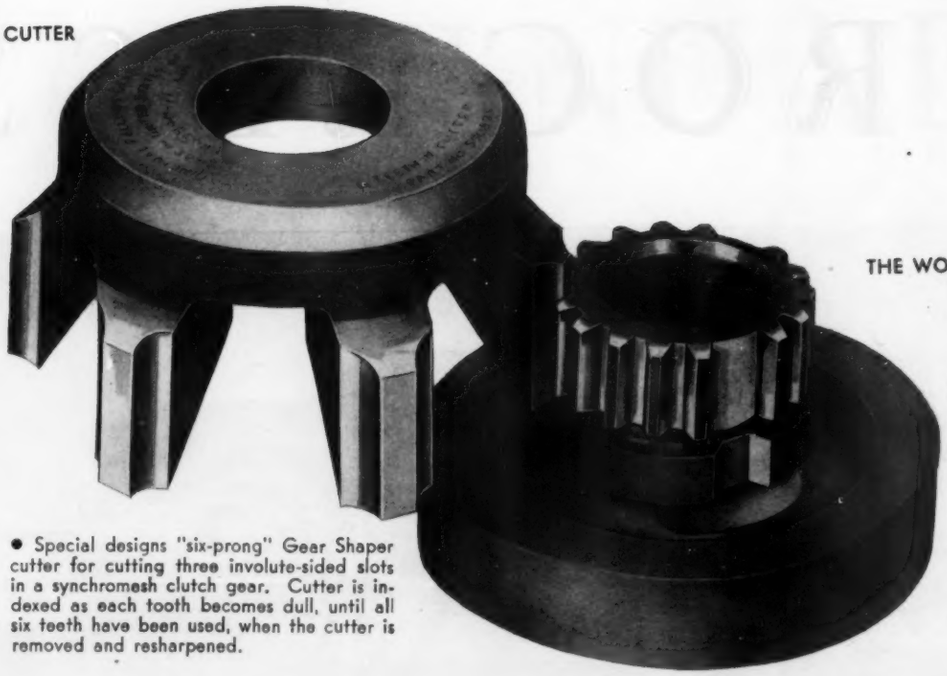
PROGRESS



Production Increased from 70 to 1

by the *Gear Shaper*

THE CUTTER



THE WORK

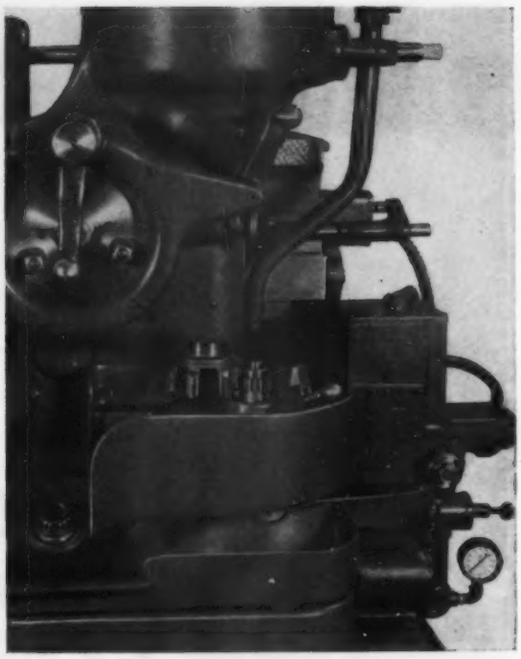
• Special designs "six-prong" Gear Shaper cutter for cutting three involute-sided slots in a synchromesh clutch gear. Cutter is indexed as each tooth becomes dull, until all six teeth have been used, when the cutter is removed and resharpened.

The Fellows Line of Products includes:

GEAR SHAPERS • HOURGLASS GEAR SHAPERS • COMPLETE LINE OF CUTTERS • THREAD GENERATORS • MASTER GEARS • LAPS AND LAPPING MACHINES

120 per hour

Method



Full automatic operating cycle: the first of 3 slots is cut, the cutter backs out without stopping its high speed reciprocation, the work indexes and the cutter feeds in again—repeating for the third slot, when the machine stops. A new blank is loaded and the automatic cycle repeats.

The job is the cutting of three involute-sided slots in the hub of a synchromesh clutch gear, below the level of the rim of the blank.

The work was formerly done on a special machine of single-purpose design which produced 70 pieces per hour.

A standard High-speed Gear Shaper arranged with automatic electrical control for indexing of the work and machine operation increased production from 70 to 120 pieces per hour.

A special cutter having six prongs or teeth is used. This cutter is reciprocated but does not rotate. As each tooth becomes dull, the operator indexes the cutter to bring another tooth into operation. This is repeated until all of the teeth are dull, when the cutter is removed and resharpened.

This is another example of the extreme versatility of the Gear Shaper Method and illustrates how a standard Gear Shaper can be adapted to special work to increase production and lower costs.

THE FELLOWS GEAR SHAPER COMPANY

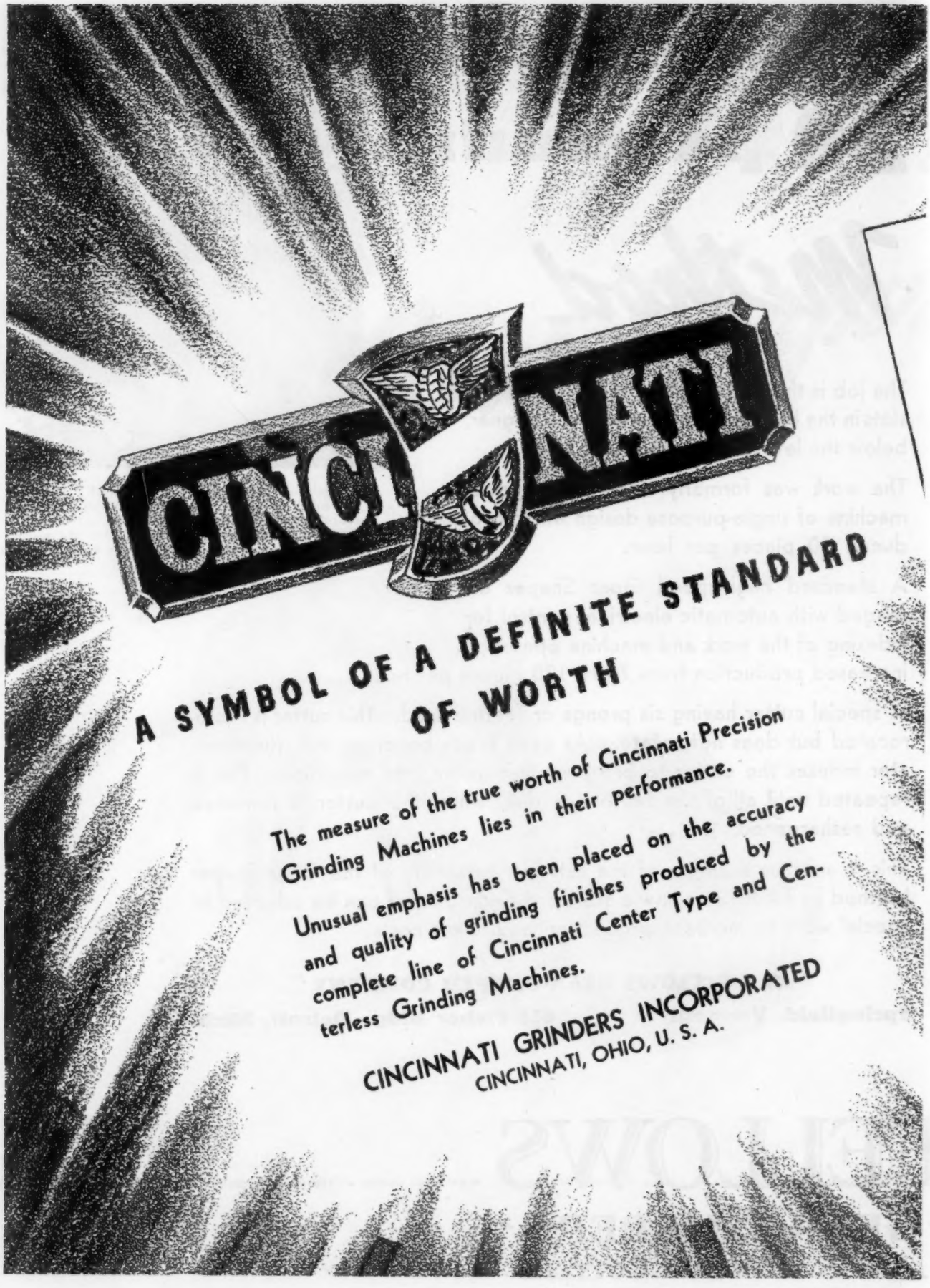
Springfield, Vermont **616 Fisher Bldg., Detroit, Mich.**

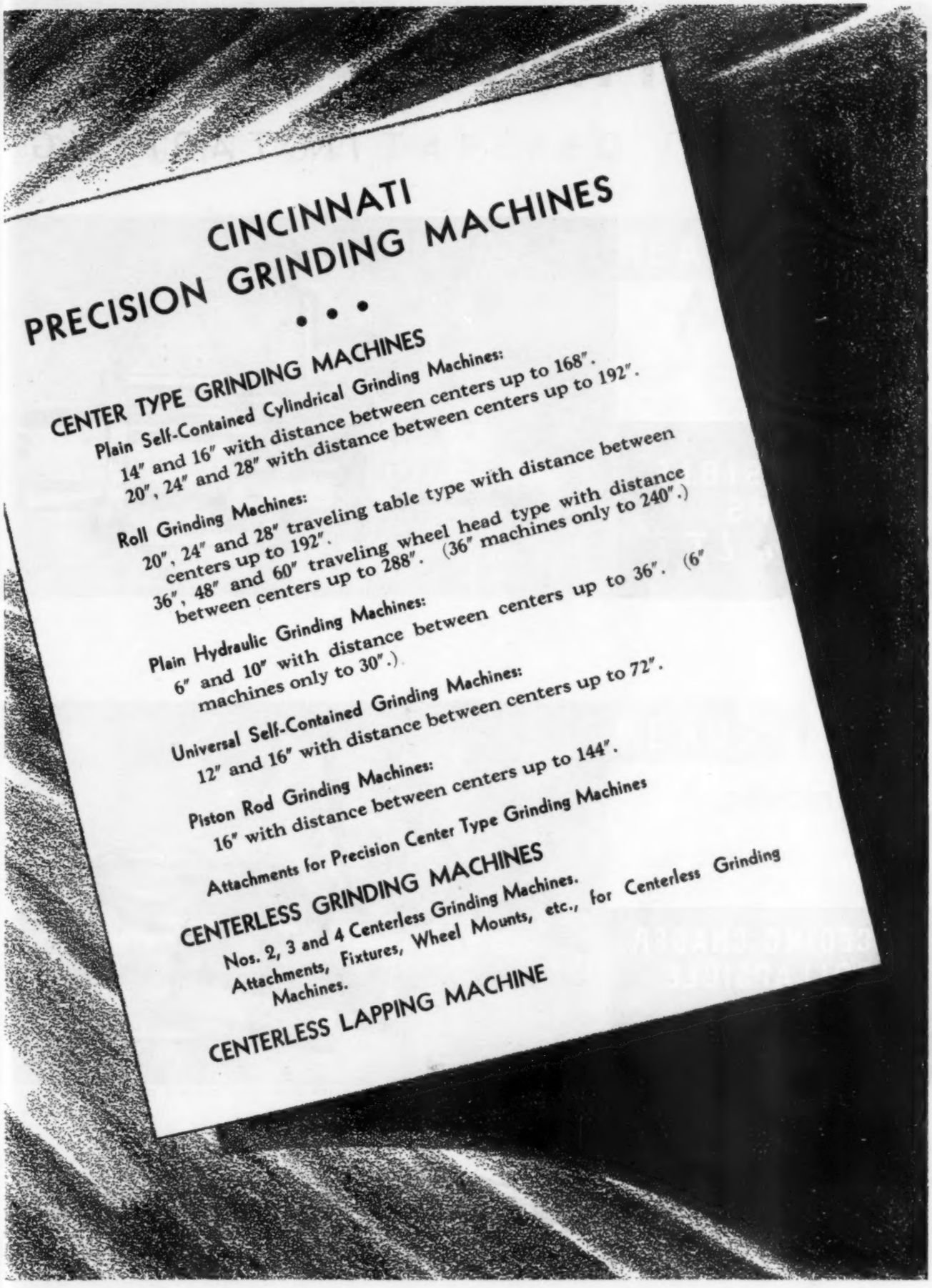
FELLOWS

BURNISHING GEARS • TESTING EQUIPMENT • HELICAL CUTTER SHARPENERS

·GEAR SHAPERS·

AND GEAR SHAPER CUTTERS

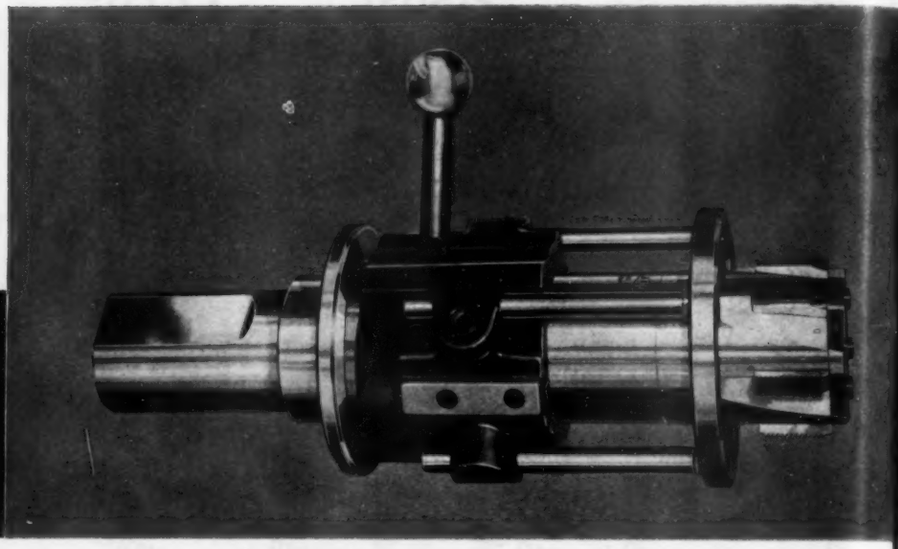

CINCINNATI
A SYMBOL OF A DEFINITE STANDARD OF WORTH
The measure of the true worth of Cincinnati Precision Grinding Machines lies in their performance.
Unusual emphasis has been placed on the accuracy and quality of grinding finishes produced by the complete line of Cincinnati Center Type and Centerless Grinding Machines.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO, U. S. A.


CINCINNATI
PRECISION GRINDING MACHINES
• • •
CENTER TYPE GRINDING MACHINES
Plain Self-Contained Cylindrical Grinding Machines:
14" and 16" with distance between centers up to 168".
20", 24" and 28" with distance between centers up to 192".
Roll Grinding Machines:
20", 24" and 28" traveling table type with distance between centers up to 192".
36", 48" and 60" traveling wheel head type with distance between centers up to 288". (36" machines only to 240".)
Plain Hydraulic Grinding Machines:
6" and 10" with distance between centers up to 36". (6" machines only to 30".)
Universal Self-Contained Grinding Machines:
12" and 16" with distance between centers up to 72".
Piston Rod Grinding Machines:
16" with distance between centers up to 144".
Attachments for Precision Center Type Grinding Machines
CENTERLESS GRINDING MACHINES
Nos. 2, 3 and 4 Centerless Grinding Machines.
Attachments, Fixtures, Wheel Mounts, etc., for Centerless Grinding Machines.
CENTERLESS LAPPING MACHINE

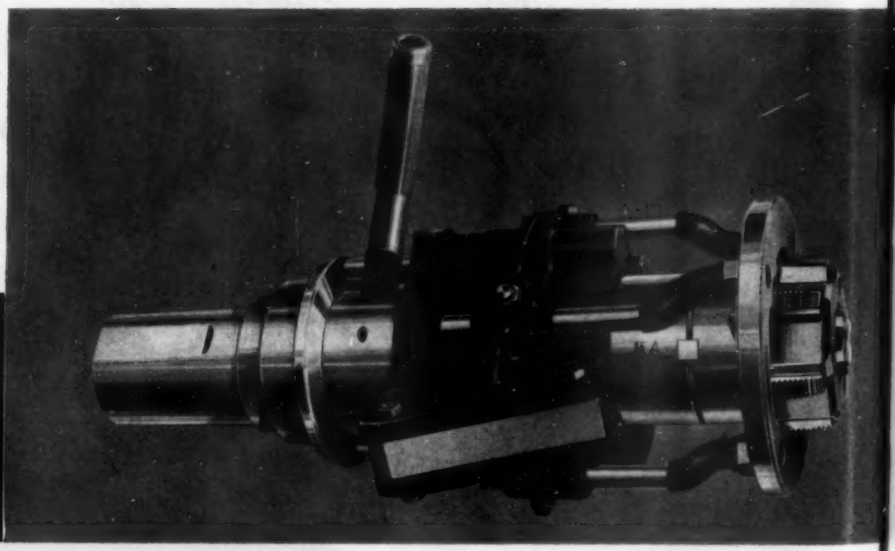
SAVE TIME + POWER

IN TAPPING

COLLAPSIBLE TAPS *Style LT*



RECEDING CHASER COLLAPSIBLE TAPS *Style LM*



LANDIS

REG. U. S. TRADE-MARK PAT. OFF.

and CHASERS

STRAIGHT OR TAPERED THREADS•

•for TAPPING STRAIGHT THREADS

The LANDIS Style LT Collapsible Tap—a recent development—is a sturdy production tool for tapping straight threads. Where thread length does not exceed chaser length, it can also be used for taper thread tapping.

All operating parts of the Style LT are of steel with parts subject to wear either heat treated or hardened and precision ground. These taps are of rugged construction with rigid chaser support.

They can be depended on for positive action, accuracy and long life. Bodies can be used for either right or left hand threads.

LANDIS Style LT Taps may be used as either stationary or rotary taps and are easily converted for either service.

featuring •

Collapsing action which frees chasers from work and permits removal of tap without reversing it.

Tap Head is detachable, permitting the use of taps of various sizes and capacities on the same tap body.

Chasers of high speed steel. Thread form as well as locating and supporting surfaces are precision ground after hardening. Chasers rigidly supported and held in position on hardened and ground seats.

Diametrical adjustment provided to obtain required thread size and compensate for chaser wear and regrinding.

Built in five sizes and cover a combined range from 1¼" to 13¼" inclusive.

For complete details of the Style LT, write for Bulletin No. G-83-2.

•for TAPPING TAPERED THREADS

The LANDIS Style LM Receding Chaser Collapsible Taps—designed for tapping tapered threads in *any machineable material*—assure more and better threads at lower cost. They are guaranteed to produce threads well within the tolerances specified by National Screw Thread and API.

These are all steel taps—with parts subject to wear either heat treated or hardened and precision ground. They can be depended on for highest accuracy and efficiency.

Style LM Taps may be used for either stationary or rotary service. Conversion for use in either service is easily and quickly accomplished. The tap body is adaptable for either right or left hand threads.

featuring •

An adjustable cam which cuts two tapers of any combination (on 4" taps and larger).

A receding chaser action insures low and uniform cutting strains and results in longer chaser life, greater thread accuracy and smoother thread finish. Power consumption is reduced by this feature of operation.

Ground thread form guarantees accurate work and long life.

An oversize adjustment compensates for diametrical reduction due to chaser wear.

A diametrical adjustment is provided for close or loose fits.

Detachable head permits the use of several head sizes with the same tap body.

Wide flutes afford liberal chip clearance.

Clamping screws afford quick and simple adjustment for thread length.

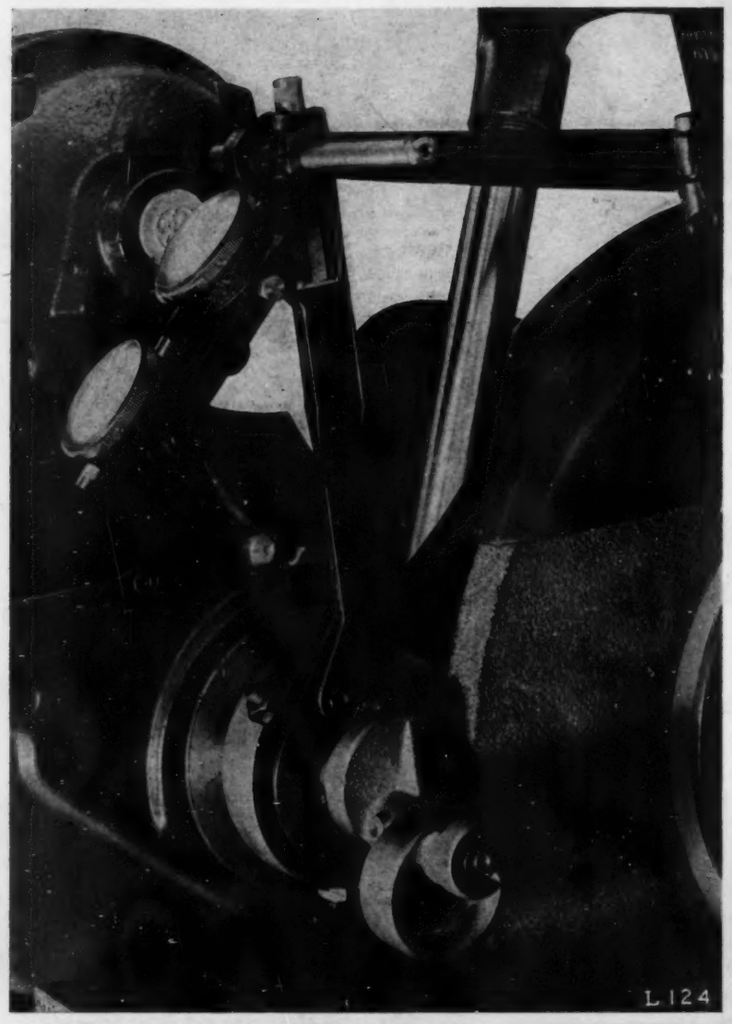
Built in five body sizes and in nineteen head sizes, from 1" to 12" inclusive.

For complete details, ask for Bulletin No. G-81-2.

LANDIS MACHINE COMPANY, INC.

Waynesboro, Pa.

IT'S A COLD WORLD



It is a cold world inside of an electric refrigerator. That is, if the compressor unit is operating efficiently. Properly ground parts contribute much to this.

Many refrigerator manufacturers are, as a consequence, using modern Landis Hydraulic Grinders. Such parts as eccentric shafts (the set-up shown here), crankshafts and pistons are being ground accurately and rapidly. The result is a better product at less cost and greater user satisfaction.

In many other fields Landis equipment is proving a large factor in the securing of similar results. 218

LANDIS TOOL CO.
WAYNESBORO, PA.

Station Type Machines "HOLEUNIT" Construction

• NATCO HOLEUNITS are flexible and interchangeable . . . are completely self-contained and no connections other than electrical are required. They represent the result of years of experience in building high production multiple head multiple spindle drilling, boring and tapping equipment . . . and they make possible the building of highly specialized machines for high production . . . yet they are standard in every respect.

• Equipped with a semi-automatic hydraulic feed, these NATCO HOLEUNITS will operate at any angle. They may be arranged in groups to perform all the required operations on a casting with a single handling. Should the part for which the units are arranged be altered or discontinued, it is only necessary to rearrange the units, equip them with new spindle boxes and the machine may be used for an entirely different piece of work.

• Illustrated at the right is a NATCO Station Type machine . . . distinctly a single purpose machine built to perform a total of 64 drilling, boring, chamfering, rough and finish reaming and milling operations on a cast iron cylinder block . . . yet the machine is built of standard NATCO HOLEUNITS . . . and may be altered as required with a minimum of expense.

• NATCO HOLEUNITS are built in a variety of sizes and capacities. Call, wire or write for a NATCO representative. Investigate these NATCO HOLEUNITS today.

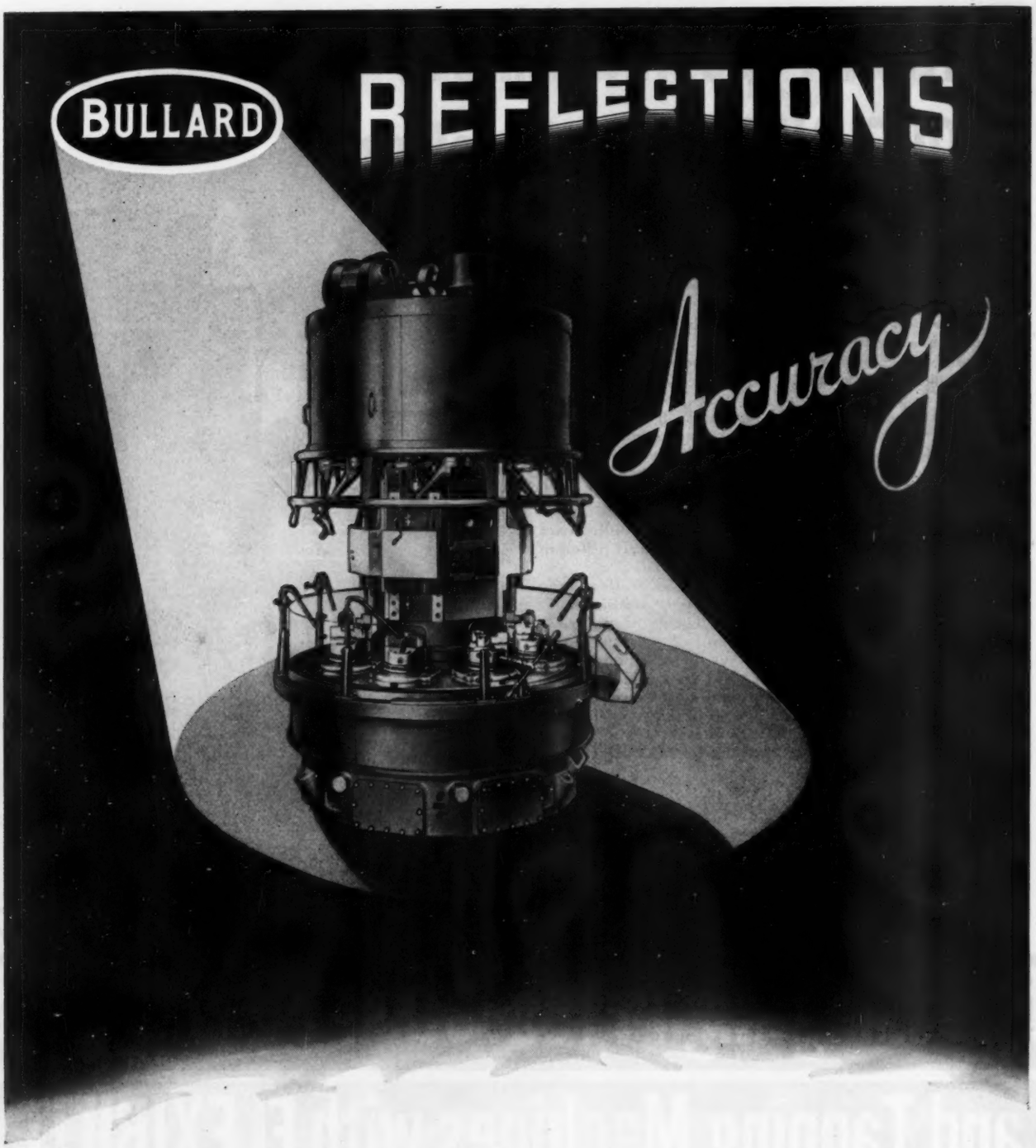
Here is the NATCO *method*

of Building High Production Drilling, Boring and Tapping Machines with FLEXIBILITY

• It's our business to lower your costs and increase your profits. Get a step ahead of competition and lower your costs now. NATCO Engineers will be glad to study your drilling, boring and tapping problems. Without any sort of obligation on your part we will make a careful survey and lay our recommendations before you . . . then you be the judge as to whether they can save you money. Send in your prints or call a NATCO representative today.

• Chicago Office, 2009 Engineering Bldg., 205 West Wacker Drive; Detroit Office, 409 New Center Bldg. Factory and Home Offices, **The National Automatic Tool Co., Richmond, Indiana, U. S. A.**

NATCO Drilling, Boring, and Tapping Equipment



Accuracy of Work with Minimum Spoilage is a natural order of things on Mult-Au-Matic Production.

This is so because of the Accuracy built into the machines themselves.

And besides—the human element of inaccuracy has been eliminated through design and automatic operation.

It, therefore, applies that alone through the Accuracy phase of manufacturing, the Bullard Mult-Au-Matic affords a means toward Improved Profits.

Bullard estimates on your work consider and assure machining Accuracy to your specified Standards.

Consider, Investigate, and Compare Mult-Au-Matics for your next order of plant Equipment.

THE BULLARD COMPANY
Bridgeport, - - Connecticut

THESE TWO *CAN'T BE FOOLED*

NOTHING LESS THAN A SUFFICIENT RANGE OF *Live Action* CAN COMBAT THE FORCES OF WEAR AND VIBRATION . . .

Theories may sound good but it takes action . . . *Live Action* to keep machinery tight! No bolt or nut ever loosened *initially* from vibration or shock because it *turned backwards* upon its threads. The friction and adhesion in the threads is infinitely more than enough to resist backward turning due to vibration and shock so long as the *pressures* set up by the wrenching in the original assembly *are maintained.* Only a SPRING WASHER *can do this.*

There is no substitute for a spring washer

SPRING WASHER INDUSTRY
616 WRIGLEY BUILDING, CHICAGO, ILL.

ONLY A SPRING WASHER HAS Live Action!

PROGRESSIVE

▲ No. 10 Plain Milling Machine

—a new **electrically controlled** production unit for the rapid manufacture of small parts, combining many of the proved design features of the successful new design No. 12 Plain Milling Machine . . . and many advanced construction features of the increasingly popular "Light Type."

▲ No. 0 Omniversal Milling Machine

—redesigned to incorporate an omniversal milling head that can be used on the side of the machine or in either of the overarm locations—**added** versatility for this unique machine tool.

▲ No. 2 Wire Feed Screw Machines Motor Driven and Overhead Driven

—new in design with new features that make these semi-automatic machines more profitable on short runs or second operations, due to higher spindle speeds—broader range of work —high ratio between high and low speeds.

▲ No. 00 Automatic Screw, Turret Forming and Cutting-Off Machines

—redesigned to provide for increased spindle speeds to 6000 R.P.M. and increased capacity to $\frac{3}{8}$″ dia. ($\frac{1}{2}$″ for light work), giving maximum production regardless of the material.

BROWN &

DEVELOPMENTS during 1936

▲ No. 20 Plain Grinding Machine (10" x 18")

—a new production grinder employing proved design principles of **electrical control** in a sturdy machine, giving increased productive capacity and more closely controlled accuracy.

▲ No. 22 Plain Grinding Machine (10" x 36")

—another new production grinder, similar to the No. 20, but of larger capacity in length.

▲ No. 10 Cutter and Tool Grinding Machine

—a new **advanced design** motor driven machine. Reduced height and convenient location of controls enable cut to be watched from a single operating position.

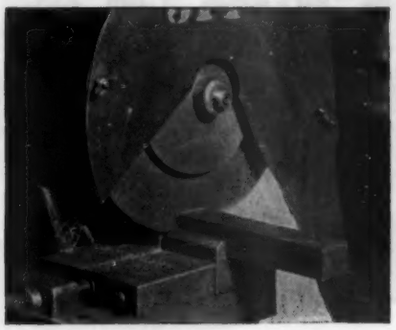
B·S

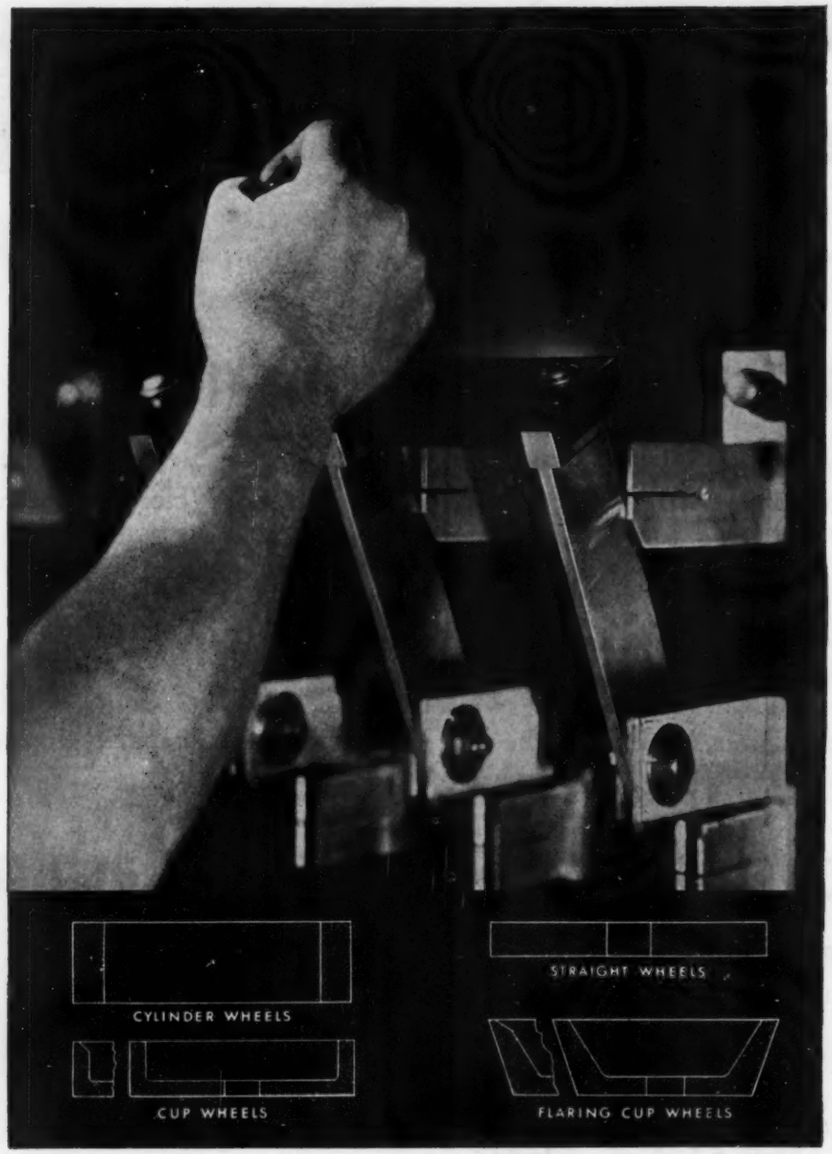
May we send detailed information on these progressive developments in modern machine tools? BROWN & SHARPE MFG. CO., Providence, R. I., U. S. A.

BROWN & SHARPE

SWITCH TO High Speed

FOR GRINDING ECONOMY





TO MANUFACTURERS seeking cost reductions through modernization of plant equipment, the grinding department may offer important opportunities for savings. The past ten years' progress in abrasive wheels and machines has now made *high speed* available for nearly every grinding operation.

Modern abrasive wheels, speed-bonded with Bakelite Resinoid, have established new performance records throughout industry. In snagging work, for example, they operate safely and continuously at speeds as high as 9,500 s.f.p.m.; in cut-off, up to 16,000 s.f.p.m. They save time, decrease wheel-dressing and produce better finish.

Important characteristics of Bakelite Resinoid bonded wheels that permit such accelerated operation, are: great strength to resist chipping and breakage; heat resistance to prevent softening and gumming; and porous structure that insures cool operation.

In a growing number of instances, manufacturers have cut grinding costs 30% to 50% by adopting Bakelite Resinoid bonded wheels. Ask your abrasive wheel supplier about these speed-bonded wheels for your plant. Leading wheel manufacturers make them. Write for our informative booklet 14G, "High Speed Abrasive Wheels."

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.
BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario, Canada

BAKELITE

The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the legend "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products.

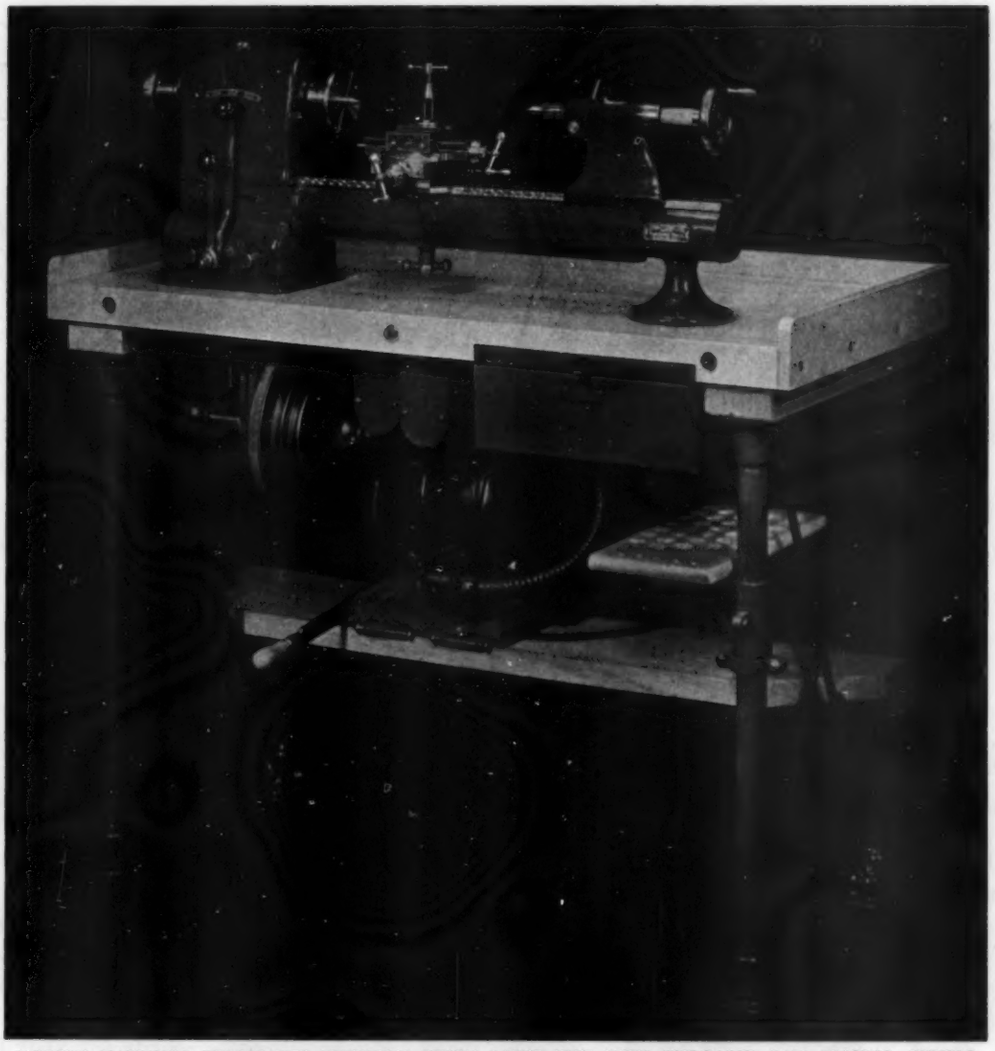
BONDED WHEELS

FOR ECONOMICAL HIGH SPEED GRINDING

Cataract

HARDINGE

PRECISION
BALL BEARING
BENCH LATHE UNITS



MODERN HARDINGE "CATARACT" PRECISION BENCH LATHE UNIT WITH PRELOADED BALL BEARING SPINDLE

FIVE SIZES FOR

PRODUCTION, TOOL-ROOM AND LABORATORY DEPARTMENTS

HARDINGE BROTHERS, INC. + + ELMIRA, N. Y.

CHICAGO — NEW YORK — DETROIT

TEXACO

PROLONGS gear life

You find Texaco at work everywhere—in the power-houses, in the machine-shops, in gear-driven equipment.

One notable example of Texaco at work is the performance of Crater in lengthening the life of gears.

This lubricant cushions gear teeth in a pressure-proof, wear-defying film that resists the wiping action of gears in mesh. Reduces nerve-racking gear noise. It *clings* to metal surfaces, lasting several times as long as ordinary lubricants.

Apply Crater and experience a quieter, more trouble-free, dependable performance from your gear-trains. The Texaco-trained representative will be glad to provide practical engineering service to prove the economies of Texaco Products.

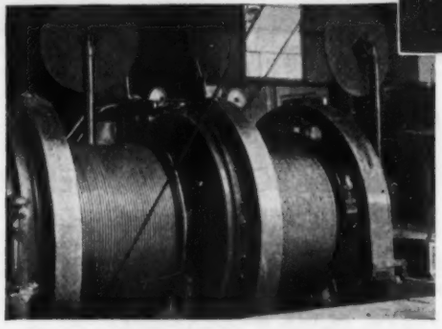
☆ ☆ ☆

THE TEXAS COMPANY

135 East 42nd Street • New York City

Nation-wide distribution facilities assure prompt delivery

READ THIS BOOKLET—32 pages of money-saving information for all who operate gears or wire rope. Shows where to use Crater and how. Illustrates simple devices for applying Crater to wire rope. Write for your free copy.



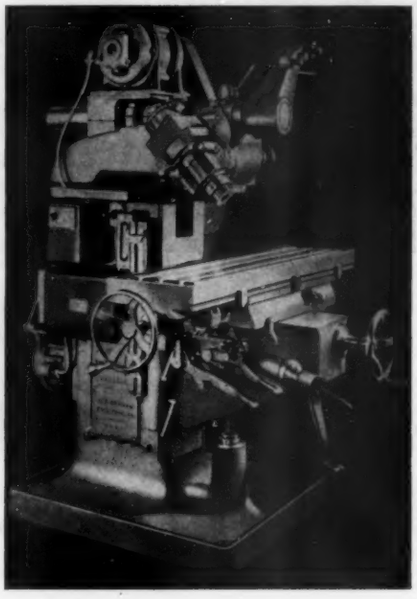
FOR WIRE ROPE—Crater seals each wire of each strand in a tough, viscous, waterproof coating that clings despite high speed, heavy loads, in hot or cold weather. Remarkable for slushing idle machinery to protect against rust and corrosion.

AT WORK—

TEXACO

Industrial Lubricants

EXTRA set-ups take time and cost money. Save both with a Van Norman Universal Miller. The cutter head can be easily and accurately set at any angle from vertical to horizontal; the ram on which the main cutter head is mounted can be moved in or out over the column quickly and easily. No time wasted in repeated set-ups. No chance for inaccuracies to creep in. Flexibility, ease of adjustment and ability to handle a wide range of work have made Van Norman Millers preferred to all others for toolroom, pattern shop and experimental work. Write for bulletins.



VAN NORMAN
MACHINE TOOL CO.
SPRINGFIELD, MASSACHUSETTS

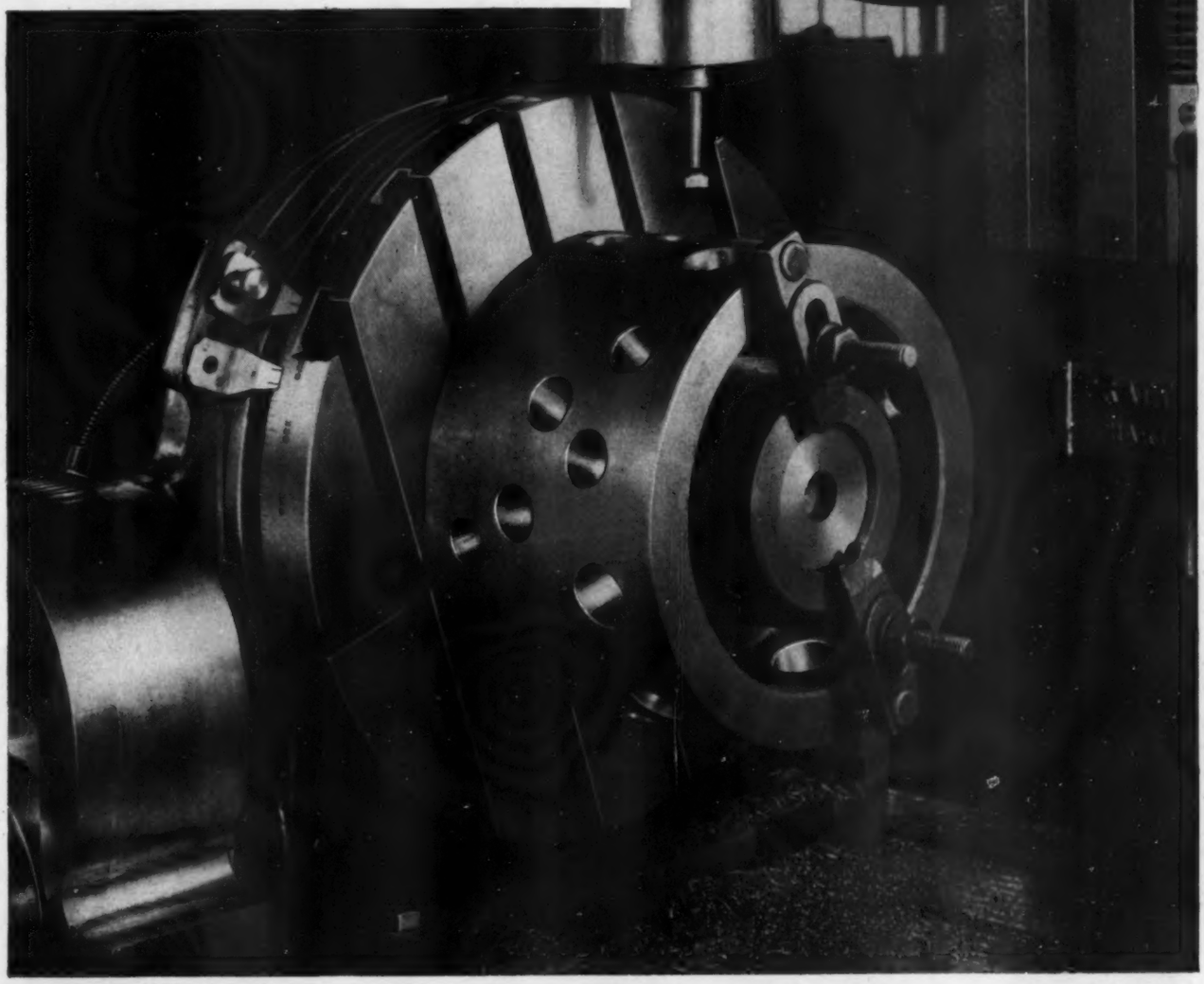
Another reason why P&W Jig Borers are industry's first choice

THIS cylindrical piece, one of several, required accurately spaced radial holes, precision bored. The P&W Jig Borer with a tilting rotary table did the job quickly. There were no special tools to make, and no troubles.

P&W Jig Borers have been doing jobs like this since 1917.

When you buy a P&W Jig Borer you buy twenty years of experience in building precision boring equipment, plus Pratt & Whitney accuracy in every detail. That is why these machines are producing dividends in hundreds of shops—and are the first choice of men who know good equipment.

Send for P&W Jig Borer literature today.



PRATT & WHITNEY DIV.

DIEGES-CLAIRMONT-POND COMPANY • HARTFORD, CONNECTICUT, U. S. A.

Achievements in flexibility.

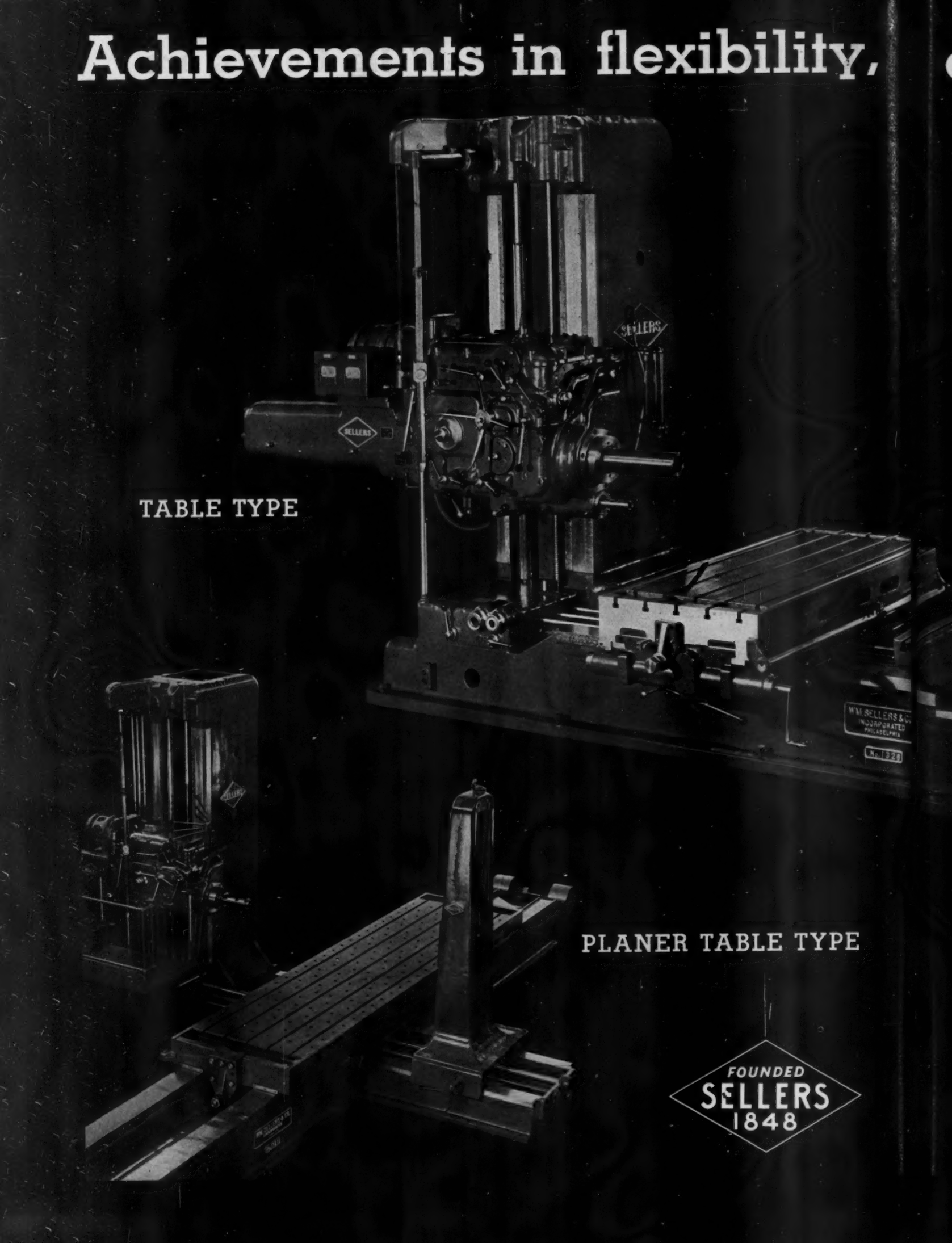


TABLE TYPE

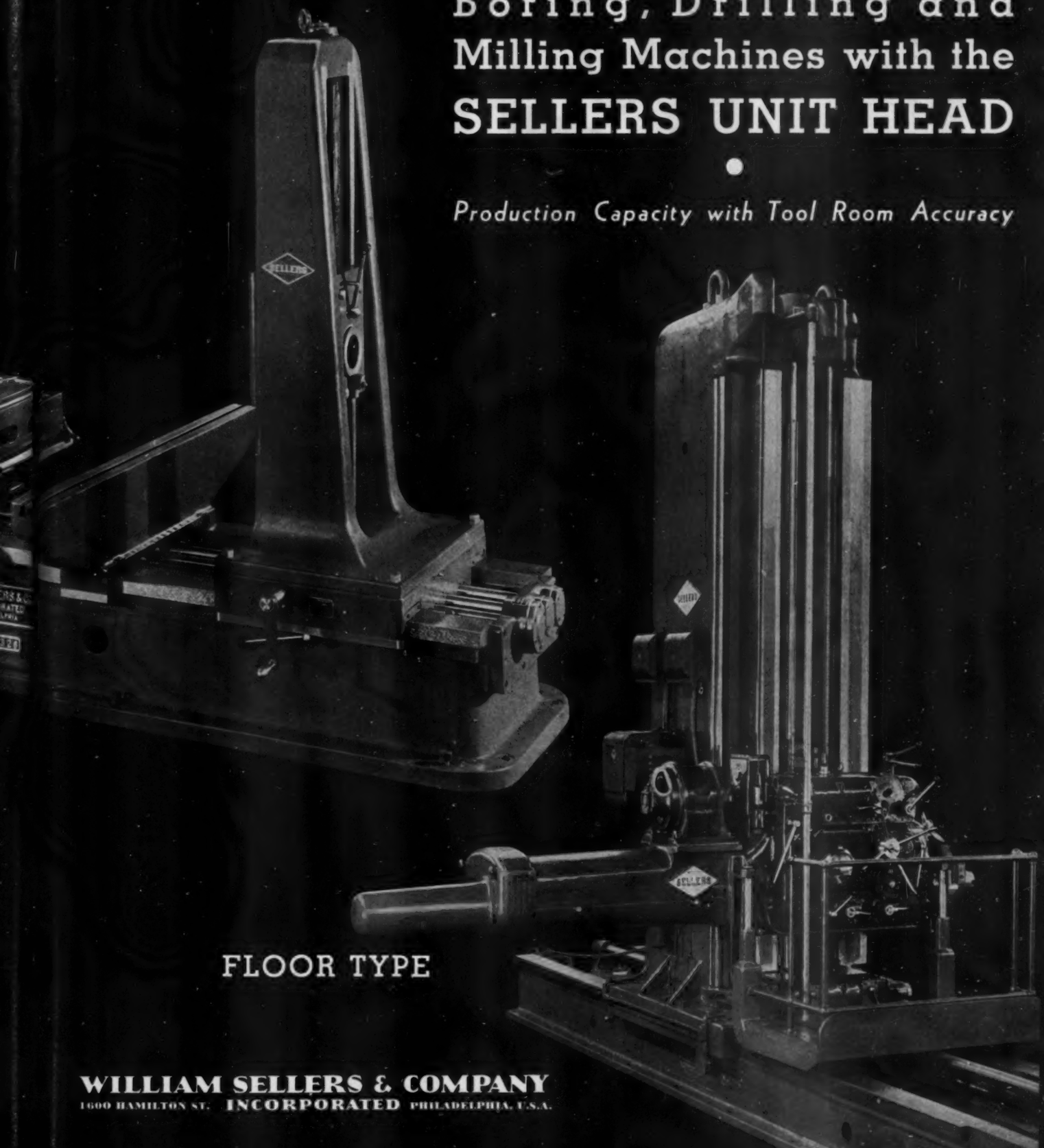
PLANER TABLE TYPE

FOUNDED
SELLERS
1848

efficiency and convenience

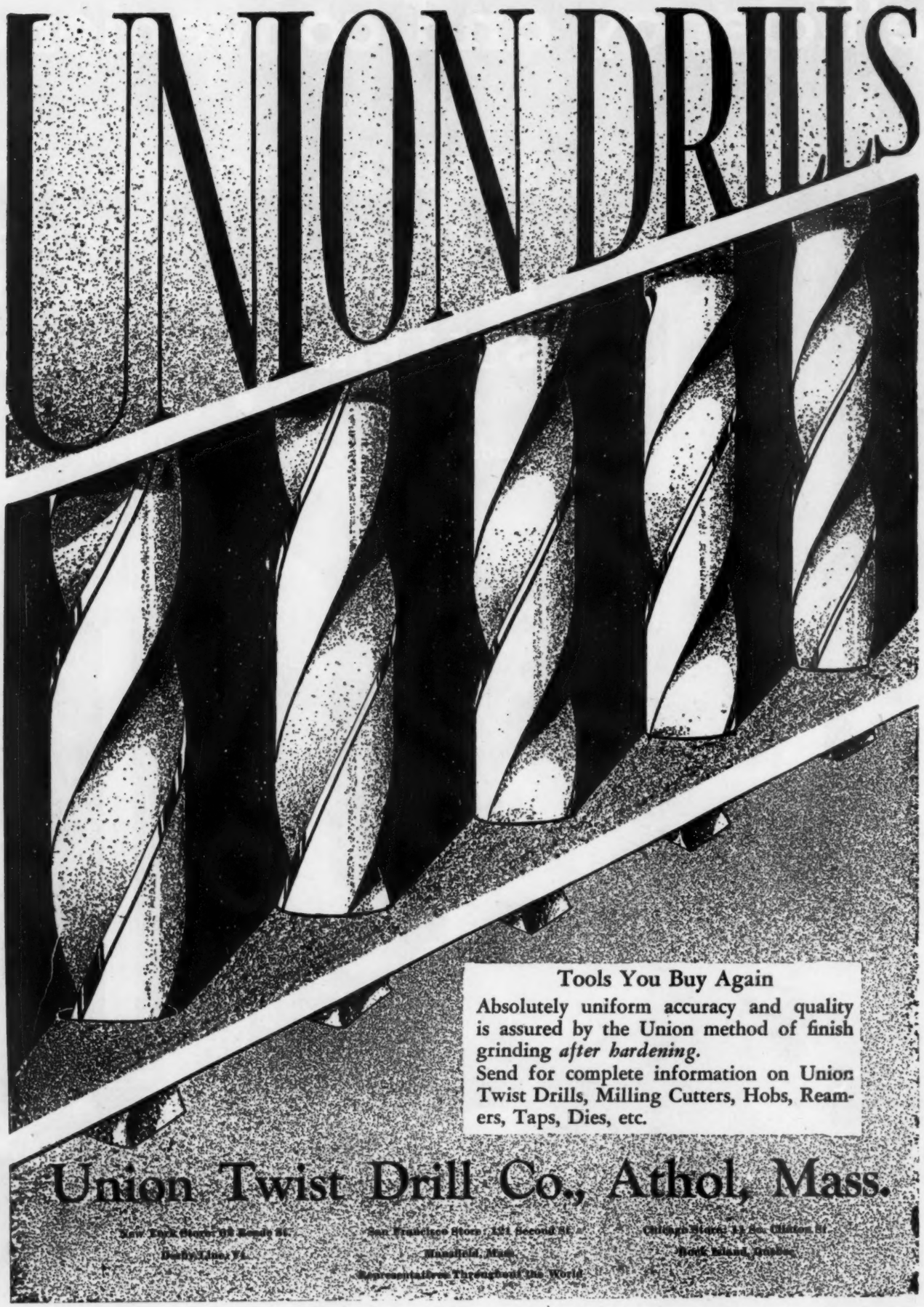
SELLERS HORIZONTAL Boring, Drilling and Milling Machines with the SELLERS UNIT HEAD

Production Capacity with Tool Room Accuracy



FLOOR TYPE

WILLIAM SELLERS & COMPANY
1600 HAMILTON ST. **INCORPORATED** PHILADELPHIA, U.S.A.



Tools You Buy Again

Absolutely uniform accuracy and quality is assured by the Union method of finish grinding *after hardening.*

Send for complete information on Union Twist Drills, Milling Cutters, Hobs, Reamers, Taps, Dies, etc.

Union Twist Drill Co., Athol, Mass.

New York Store: 93 Reade St. — San Francisco Store: 121 Second St. — Chicago Store: 11 So. Clinton St.

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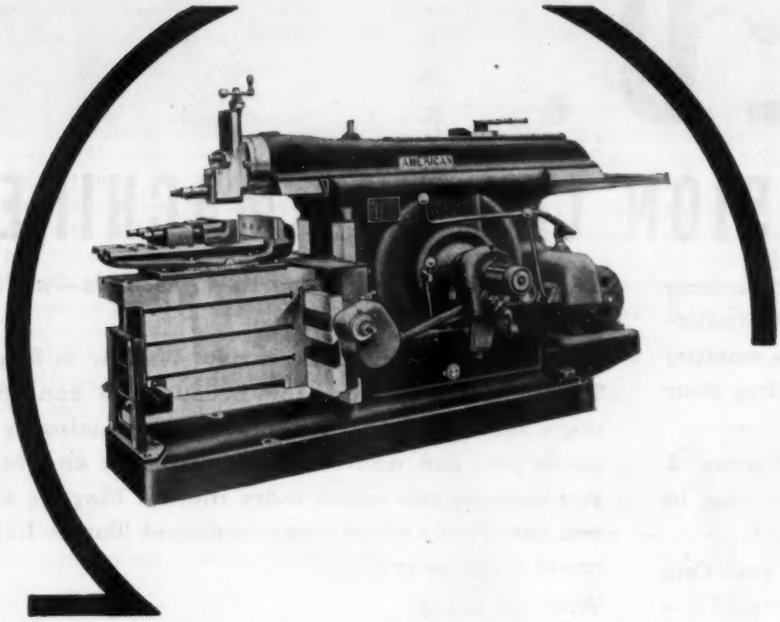
Representatives Throughout the World



"AMERICAN"

AUTO-OILED

SHAPERS

60% ahead in productivity

THE "AMERICAN" Auto-Oiled Shaper sets a new standard in quantity and quality of work produced.

Measured against the performance of shapers only ten years old, the new "AMERICAN" has demonstrated its ability to produce 50% more work in a given time.

This tremendous increase in productivity has been achieved not only through greater power and rigidity, but through vastly improved convenience in control. Quality of work, too, has been stepped up and greater durability provided.

Another feature which contributes to remarkable performance is automatic lubrication. As its name implies, the "AMERICAN" Auto-Oiled Shaper is automatically lubricated throughout. Every bearing, gear, the bull wheel and rocker arm, and all their parts, ram guide ways and multiple disc driving clutch are constantly flooded with filtered oil under constant pump circulation.

Other features which stamp the "AMERICAN" modern and which assure outstanding performance are fully described in Catalog No. 200. Write for your copy.

LATHES
RADIALS
SHAPERS

THE AMERICAN TOOL WORKS CO.

CINCINNATI . . . . . OHIO

NEEDED:

AN OLD-AGE PENSION LAW FOR MACHINES

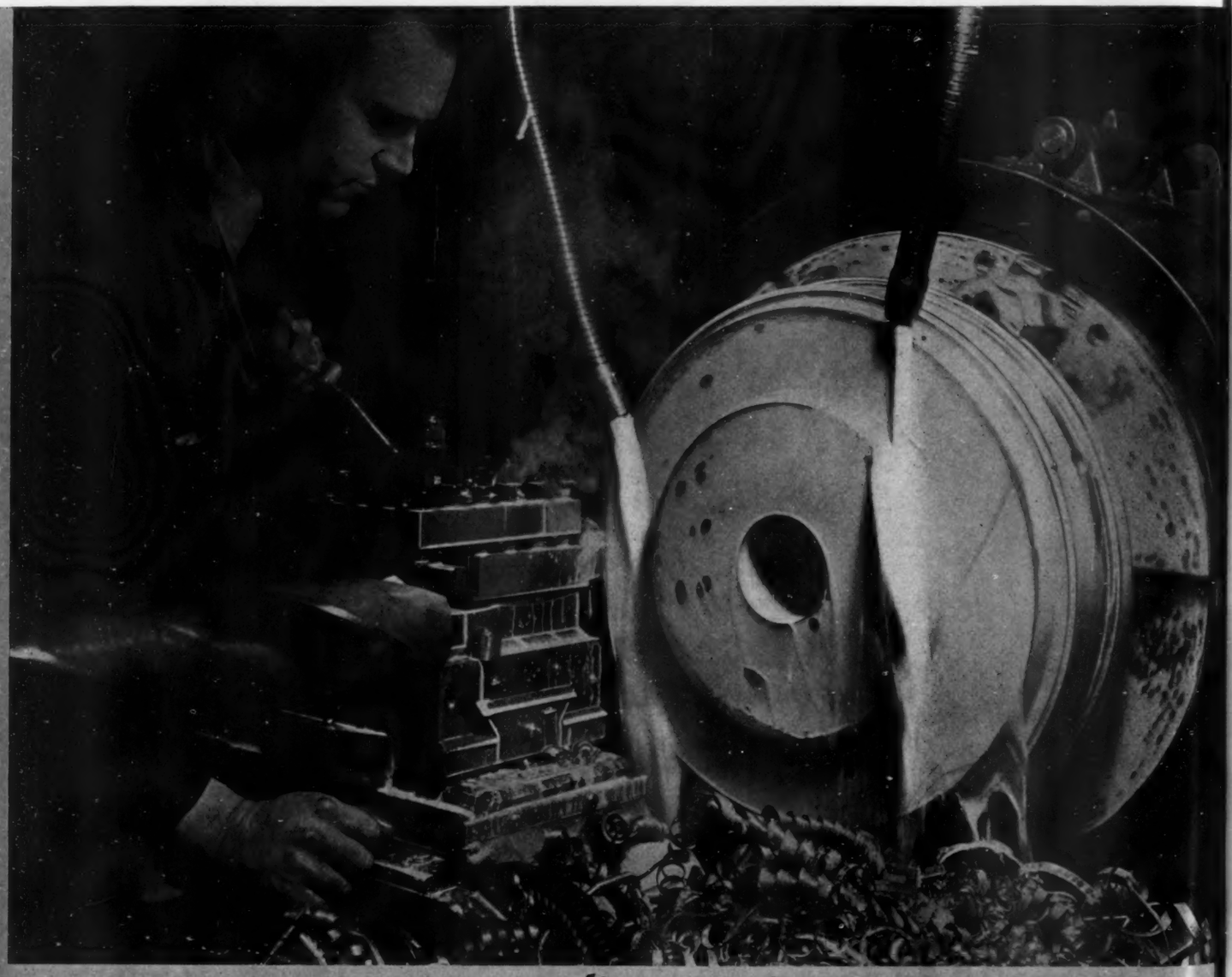
THERE may be machines in your plant working for your competitors. Any machine not producing as much as its modern counterpart is wasting your money, adding to your costs, reducing your profit. Junk it.

Turret Lathes, for example. The new Warner & Swasey Turret Lathes show an average increase in production of 30% over 1929 machines.

That 30% can be almost pure net profit to you. One shop, typical of scores, cut production time 87%—from 6 minutes per piece to 45 seconds—without increasing overhead!

Everyone is benefited by a new Warner & Swasey Turret Lathe——operator because he can make more money on shorter hours; your customer because you can deliver better precision and value; you because you make more money. May we show you concretely what these improved Turret Lathes could do in your shop?

Write us today.



WARNER & SWASEY *Turret Lathes* CLEVELAND

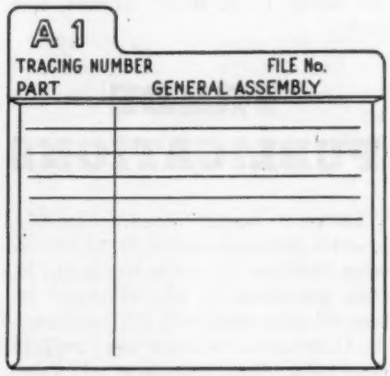
Make This the Turning Point to Increased Earnings

How Would You File Large Rolled Tracings?

S. A. INSCOE
Wolverhampton, England

In reply to the above query (*AM*—Vol, 80, page 328), I would say that the first essential for any filing system would be that the tracings be lettered or numbered with symbols to indicate special machines or tools, models, groups, types, parts, general assemblies or material lists. By compiling a full and complete reference list of the establishment's undertakings and separate manufacture in correct sequence, under name and group headings, a card index of the tracings classified under symbol headings may be arranged to correspond.

The tracings may then be grouped in any convenient manner, either for



The index card has a pocket in which is kept a requisition slip initialed by the drafting room clerk. The slip shows whether the tracing is in or out and, if out, who has it

housing a number of similar lengths, thickness, importance, or in correct sequence. As the tracings in this case are rolled, it would be advisable to roll them around light wooden sticks, at each end of which should be attached a disk bearing the symbol corresponding to the reference list. If the drawer front is numbered and could be arranged with a hinged flap immediately exposing the whole contents to view, selection of the tracing wanted would be facilitated.

A type of index card for rolled tracings is shown in the illustration. This card has a pocket and is a lead or guide card for a particular group. Those immediately following bear relation to it and have succeeding file or tracing numbers, but all the tracings of that group may not be housed in the same file.

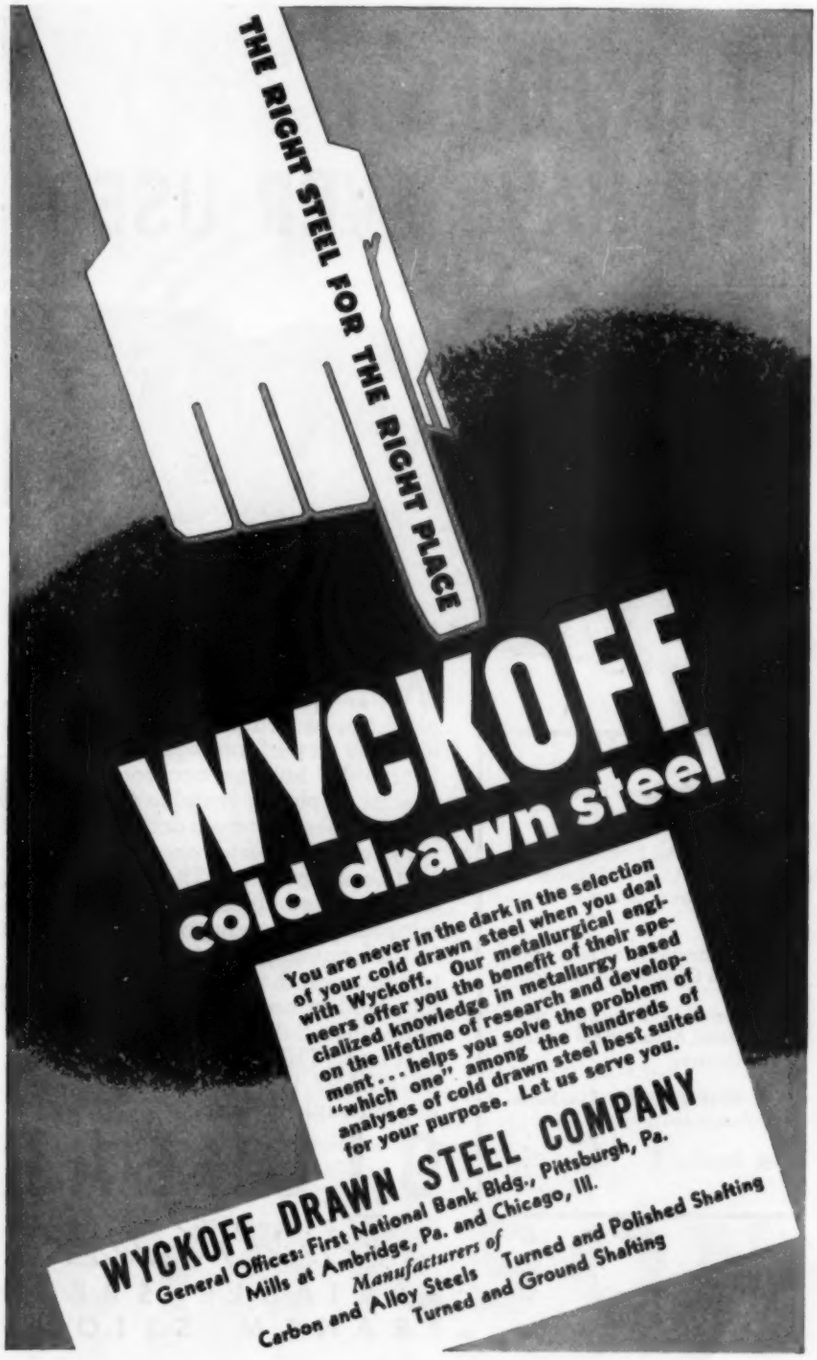
When requisitioning any tracing, the person may know either the part or the tracing number, and he makes out his requisition accordingly. Reference to the card index will indicate the file number and the section where that particular tracing is kept. In this instance, the requisition slip is initialed by the drafting-room clerk and is filed in the pocket of the index card, so that if this tracing is again called for, reference to the slip in the file card will immediately indicate whether or not it has been returned, and if not returned, who has it.

Other systems vary slightly in details, but this method of cross reference between list and card index, with groupings of components and the housing of tracings according to size, has been found to be quite simple and efficient.

Drilling Very Small Holes

C. G. WILLIAMS

The suggestions made by John R. Godfrey (*AM*—Vol. 79, page 866) are good, but in drilling holes from 0.006 to 0.012 in. in diameter, using hand


THE RIGHT STEEL FOR THE RIGHT PLACE
WYCKOFF
cold drawn steel
You are never in the dark in the selection of your cold drawn steel when you deal with Wyckoff. Our metallurgical engineers offer you the benefit of their specialized knowledge in metallurgy based on the lifetime of research and development . . . helps you solve the problem of "which one" among the hundreds of analyses of cold drawn steel best suited for your purpose. Let us serve you.
WYCKOFF DRAWN STEEL COMPANY
General Offices: First National Bank Bldg., Pittsburgh, Pa.
Mills at Ambridge, Pa. and Chicago, Ill.
Manufacturers of
Carbon and Alloy Steels Turned and Polished Shafting
Turned and Ground Shafting

feed, it is the exceptional operator who would not break enough drills to make the job quite expensive.

An inexpensive automatic feed can be applied to most high-speed sensitive drills, yet it can easily be released to permit removing the drill for cleaning or after the hole has been drilled to the required depth. Such a device would give a constant feed, a thing almost impossible under hand feed control.

A clamp could be placed on the machine to hold a magnifying glass, so that the operator could constantly watch the action of the drill and not be compelled to be continually placing the glass in the eye or contorting the face to hold it there.

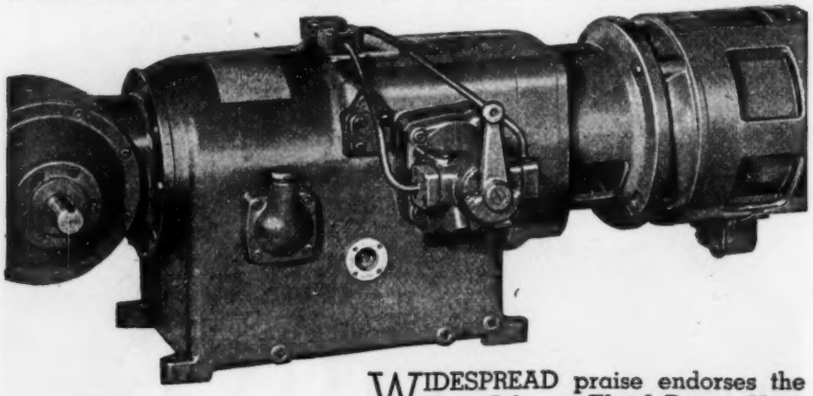
Tolerances on Materials

Fabricators of products using metal sheets or rods have come to depend largely on the accuracy of these materials as they come from the makers. Consequently large suppliers pay careful attention to sizes and have adopted standard commercial tolerances for their materials. Some of these tolerances are quite small, are given in thousandths of an inch, and are usually all plus and minus. If unilateral tolerances are demanded, that is all plus or all minus, they must be double the bilateral tolerance. Knowing these tolerances the designer and fabricator can often effect economies by eliminating unnecessary operations.

Back Numbers

A set of back numbers of *American Machinist* complete with indexes and beginning with Vol. XVI may be purchased by anyone who is interested. There are sixty-five volumes in all but only the first six are actually bound. The price is subject to negotiation with the owner, L. H. Blood, Morrill, Kentucky.

"THE FINEST WE HAVE EVER USED"



WIDESPREAD praise endorses the New Oilgear *Fluid Power* Variable Speed Transmission. Production men say its performance amazes them. It provides hairline accuracy of speed control; steplessly variable speed; even, positive speeds; smooth acceleration and reverse; a complete range of automatic and hand operation. The new simplified design makes Oilgear compact, widely adaptable and low in price. You will want full information about the transmission that is upsetting production figures in many lines. Bulletin 60000 sent free. THE OILGEAR COMPANY, 1309 W. Bruce St., Milwaukee, Wisc.

- ★ Smooth Acceleration and Deceleration
- ★ Accurate Stepless Speed Control . . . Minimum to Maximum in either direction
- ★ Automatic Load Indication and Overload Protection
- ★ Flexible Location with Hand, Automatic or Remote Control
- ★ High Efficiency, Low Maintenance
- ★ Smaller Size, Lower Cost

OILGEAR

Fluid Power

VARIABLE SPEED TRANSMISSIONS

TRADE PUBLICATIONS

ABRASIVE GRAIN SIZES. Simplified practice recommendation R118-36, covering abrasive grain size standards, has been published by the National Bureau of Standards, U. S. Department of Commerce. Copies are available from the Superintendent of Documents, Washington, D. C., at a price of 5 cents each.

APPRENTICE TRAINING. The Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, Ohio, has published a 32-p. booklet describing its apprentice training courses. The title is: The Training School.

ARC WELDERS. The Model SA-150 arc welders are described in a folder offered by the Lincoln Electric Co., Cleveland, Ohio.

BURNISHING ROLLERS. Haynes Stellite Co., Kokomo, Ind., announces publication of a 4-p. illustrated folder describing its line of burnishing rollers. Eight styles are available, six are mounted on double opposed roller bearings and two are keyed for shaft mounting.

DROP FORGING. The Chambersburg Engineering Co., Chambersburg, Pa., is mailing reprints of a paper "Developments in Modern Drop Forgings" by R. E. W. Harrison, vice-president. This is reprinted from the September and October, 1936, issues of *Heat-Treating & Forging*, and is a continua-

tion of a paper published in February and March, 1936.

FLEXIBLE COUPLING. The Boston Gear Works, Inc., Hancock & Hayward Sts., North Quincy, Mass., has published folder Form No. 7–36 in which is described the Symbol FCB flexible coupling. This three-jaw coupling is equipped with hardened and ground steel balls in contact with the hardened jaw surfaces.

GAGE BLOCKS. The Johansson Division, Ford Motor Co., 3674 Schaefer Road, Dearborn, Mich., offers a folder, Form 7540, describing gage block set No. 16 and various accessories for use by the individual mechanic. Five gage blocks that will make 31 different size gages in steps of 0.0625 in. are included in this set.

GEAR CHUCKS. Garrison gear chucks, designed for use on any standard machine and for any type of gear, are described in a folder offered by the Garrison Machine Works, Inc., Dayton, Ohio.

INDUSTRIAL OVENS. The Gehnrich Oven Corporation, Skillman Ave. & 35th St., Long Island City, N. Y., has published Bulletin No. 102 and Bulletin No. 103 describing their line of industrial ovens, dryers and air heaters. These units are available for baking, drying and heat-treating operations.

INDUSTRIAL TOOLS. Catalog No. 37-M, announced by Bonney Forge & Tool Works, Allentown, Pa., describes the Bonney line of wrenches, wrench sets, and other industrial tools.

INDUSTRIAL WIRING SURVEY. The Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y., is offering a booklet which comprises an industrial wiring survey booklet designed to facilitate investigation of the condition of electrical equipment and wiring in industrial plants. Space is provided for recording findings.

LATHE CONVERTER. The Master Machine & Tool Co., Armour & Erie Sts., North Kansas City, Mo., has published a bulletin describing the lathe converter units which make possible drilling, grinding, hobbing and milling operations on standard engine lathes.

LATHES. The South Bend Lathe Works, South Bend, Ind., has published a 24-page catalog announcing the 1937 Model 9-in. work-shop precision lathe. Over 150 illustrations are used to show the features and applications of this screw cutting lathe.

JESSOP STEELS. The Jessop Steel Co., Washington, Pa., has announced publication of General Catalog No. 5 which lists and describes the steels offered by this company.

LEIPZIG TRADE FAIR. A stiff binder containing 24 technical reports on equipment shown at the 1936 Leipzig Trade Fair, Technical Division, has been prepared by the technical staff and can be secured from the New York office of the Fair, 10 E. 40th St. The reports are in English and are well illustrated. They have been written by qualified engineers in the various fields represented. These major divisions are included: Prime Movers and Service Machines; Constructional Materials and Their Treatment (machine tools and small tools fall in this section); Electrical Engineering; Building; Technical Processes.

Ryerson Flame Cut Plates Lower Mfg. Costs

Intricate Parts Quickly Cut from Steel Plates—*All Grades*

MANUFACTURERS using Ryerson flame cut plates are saving both time and money. Strong rolled steel parts are quickly and accurately cut from mild, high carbon, or alloy quality steel. Experienced Ryerson operators with modern and complete equipment can produce any number of pieces to the most exacting specifications.

Large stocks of steel assure immediate production of your requirements. Let us show you what this Ryerson Service can save you. Send sketch or blue print for quotation and ask for Bulletin 88 which shows many parts now being produced by this method.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, Philadelphia, Cincinnati, Cleveland, Detroit, Buffalo, Boston, St. Louis, Jersey City

RYERSON
STEEL-SERVICE

MAILING LISTS. The Marketing Research Div., Department of Commerce, Washington, D. C., has published a "Directory of Mailing List Houses." This directory is available free of charge to business men who request copies on their business letterheads.

MATERIAL HANDLING. A folder, Form G–436, describing and illustrating various applications of material handling equipment has been published by the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MONEL METAL. A 48-page bulletin recently published by the International Nickel Co., Inc., 67 Wall St., New York, N.Y., describes numerous applications of monel metal. This booklet is illustrated throughout and has been prepared primarily as a guide book for the engineer.

MOTOR DRIVE UNIT. The Stark Tool Co., Waltham, Mass., is offering a folder describing the Stark motor drive unit bench lathes, millers and other bench machines. The unit mounts beneath any bench and drives through a single flat belt. Three speed changes are available through the gearbox between the motor and the driving pulley.

POWER SCREW DRIVERS. Standard units for applying screws and nuts are described in an 11-p. bulletin recently published by the R. G. Haskins Co., 4630 West Fulton St., Chicago, Ill.

PROFIT SHARING. "Sharing Profits with Employees" is the subject of a report prepared by the Policyholders Service Bureau, of the Metropolitan Life Insurance Co., New York, N.Y. A limited number of copies are available.

RUBBER MOUNTINGS. The B. F. Goodrich Co., Akron, Ohio, has issued a 4-page illustrated bulletin describing their line of rubber-to-metal mountings, known as Vibro-Insulators, designed for application on mechanical equipment to absorb shock and vibration.

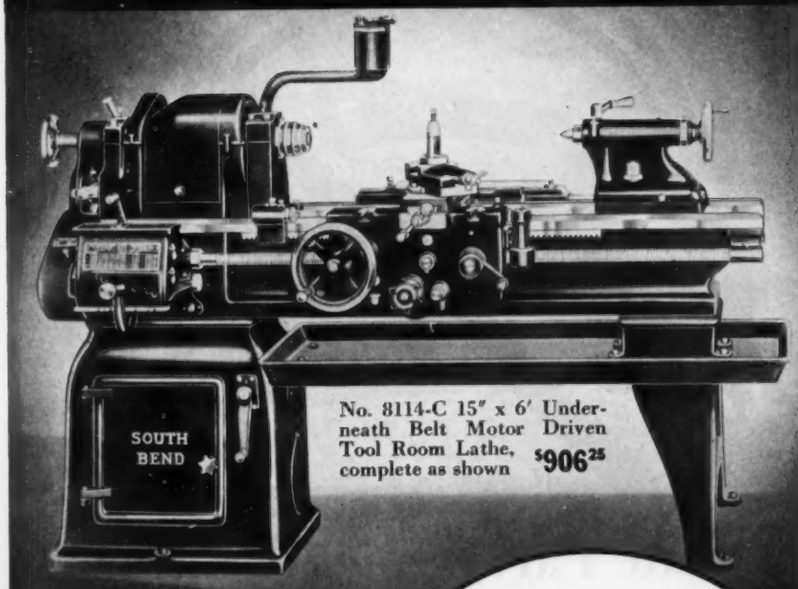
TRANSMISSION EQUIPMENT. The Boston Gear Works, Inc., Hancock & Hayward St., North Quincy, Mass., announces publication of Catalog No. 51. This 256-p. catalog lists gears, chain and chain drives, speed reducers, couplings, universal joints, pillow blocks, ball bearings and other stock products.

UNIVERSAL DIES. Wales universal perforating and notching dies, press brake perforating and notching dies, and strippit units are described and illustrated in catalog No. 5, recently published by The Strippit Corp., 1559 Niagara St., Buffalo, N. Y. This 50-p. booklet is fully illustrated with line drawings. Seven new items are shown.

V-BELT DRIVES. A combined catalog, superseding Catalogs No. 105, No. 110 and No. 160, has been announced by the Dayton Rubber Mfg. Co., Dayton, Ohio. This catalog, No. 180, gives complete data on Cog-belt drives, and V-flat drives.

WORN WIRE ROPES. Research Paper RP920, part of Volume 17 of the Journal of Research has been published by the National Bureau of Standards, U. S. Department of Commerce. Title: Inspection and Tensile Tests of Some Worn Wire Ropes. Copies can be secured from the Superintendent of Documents, Washington, D. C., at a cost of 10 cents each.

NEW 1937
SOUTH BEND *Precision* LATHES
Modern Lathes for Modern Industry



No. 8114-C 15″ x 6′ Underneath Belt Motor Driven Tool Room Lathe, complete as shown $906.25

9″ TO 16″ SWING
PRECISION
LATHES
WITH DOUBLE
WALL APRONS
AND
HARDENED
STEEL
SPINDLES

THE new 1937 Series, South Bend Lathes are recommended for the finest and most accurate work in the tool room, machine shop, manufacturing plant, and laboratory. Offered in sizes 9″ to 16″ swing, in bed lengths from 3′ to 14′, Motor Drive and Countershaft Drive.

Catalog No. 96 shows the new 1937 Series South Bend Precision Lathes in all sizes and styles. A valuable book for the shop man, engineer, and plant executive. Sent free, postpaid, upon request.

SOUTH BEND LATHE WORKS
953 East Madison Street
South Bend, Indiana, U. S. A.

. . you'll get best results with Butterfield "Commercial Ground" High-Speed Steel taps. Ground *after* heat-treating and hardening they maintain their accuracy for unbelievably long periods of service, and produce "Class 2 Fit" tolerances until entirely worn out.

Butterfield High-Speed Steel taps are available also in two other grades: "Cut Thread" for tough stringy materials and "*Precision Ground*" for use where extreme accuracy is essential. Our 200-page catalog gives complete information regarding all Butterfield Products. Ask for it at any of the stores listed below, or address:

UNION TWIST DRILL CO.,
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U. S. A.

Our Products Include

TAPS
Cut and Ground Thread

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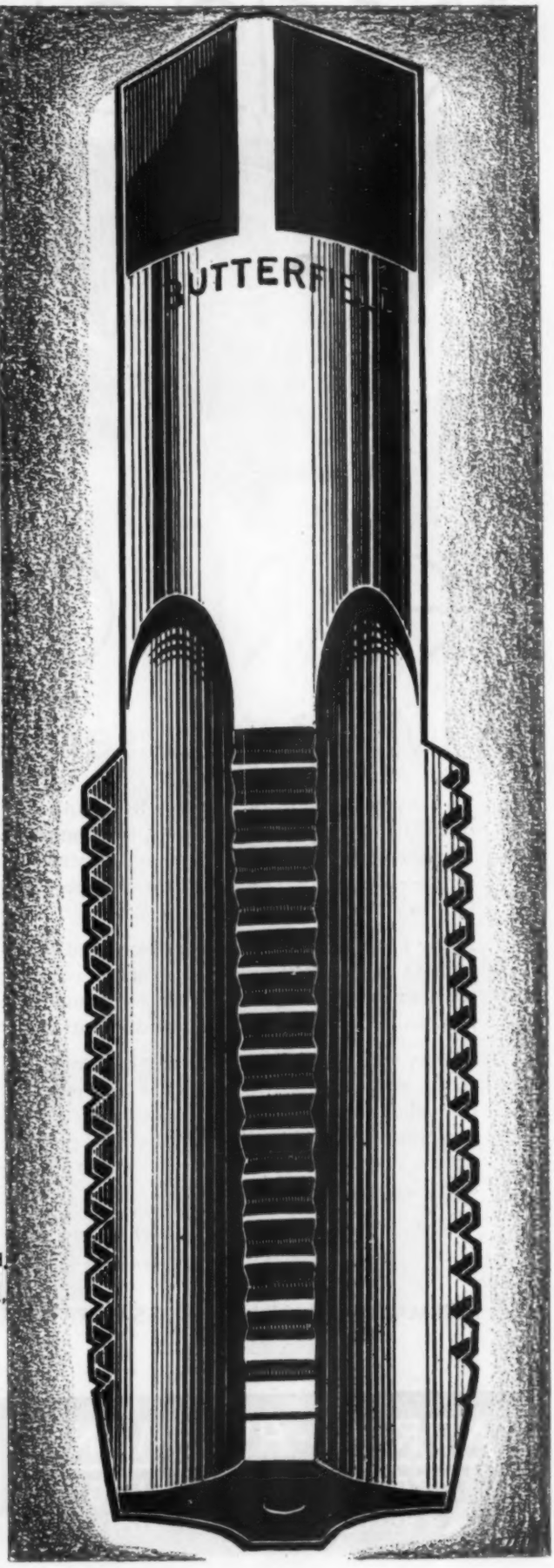

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BEARINGS

in 108 distinct series

To the machinery world, NORMA-HOFFMANN offers the most comprehensive line of anti-friction bearings in America—108 distinct series—ball, roller, needle and thrust types—1/8" to 21" bore, metric and inch sizes.

Many of these types have been pioneered by NORMA-HOFFMANN engineers to meet specific requirements growing out of advancing methods in machine design, manufacture and operation.

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BALL, ROLLER AND THRUST

Now!

Streamline UNBREAKABLE Oilers By... GITS

Unbreakable Body

Oil feed adjustment with shut-off switch.

Sight glass in shank to adjust oil feed to proper volume.

Self-closing hinge cover for easy filling.

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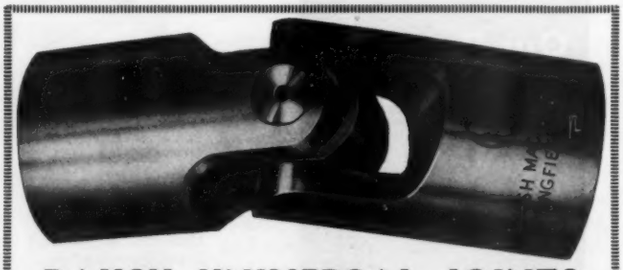

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These Universal Joints have been on the market for years, but we have made improvements both in materials used and in construction. Consists of five pieces only and can be easily taken apart and reassembled. From ¾" to 4" dia., in steel or bronze, or steel with bronze center blocks.
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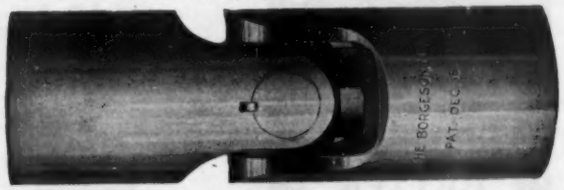
BORGESON UNIVERSAL JOINT DESIGN
insures long life in hard service



Pins are made with two flanges, one on outer end and one on inner end, the yoke being counterbored to receive outer flange, the inner flange bearing on square hole in block and providing a lock that prevents spreading. Great strength and sturdiness is assured. Adjustable. Grease packed before shipment.

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The Revolutionary RED RING DOUBLE HEAD GEAR SHAVING MACHINE

Revolutionary in principle . . . the Red Ring Two Head Gear Shaving Machine, revises production up . . . revises costs down.

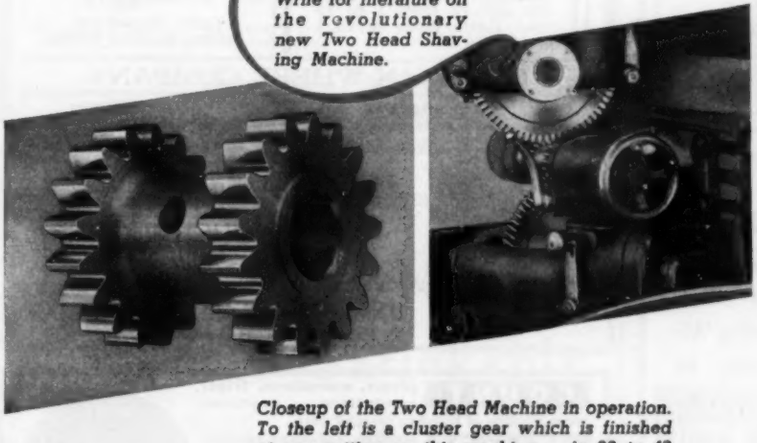
It will do both halves of a cluster gear at one operation . . . or two single gears at one operation. The saving in loading and unloading time is very great . . . costs go down . . . production up. A cluster gear of ordinary transmission size can be finished both ends in 20 to 40 seconds, floor to floor.

The principle of limited crossed axis shaving employed by this machine produces better gears faster. Profile . . . index . . . eccentricity . . . helix angle are corrected to high precision. Profile, for example, is brought to within 0.0001" of true involute. Surface of teeth is rendered bright and smooth.

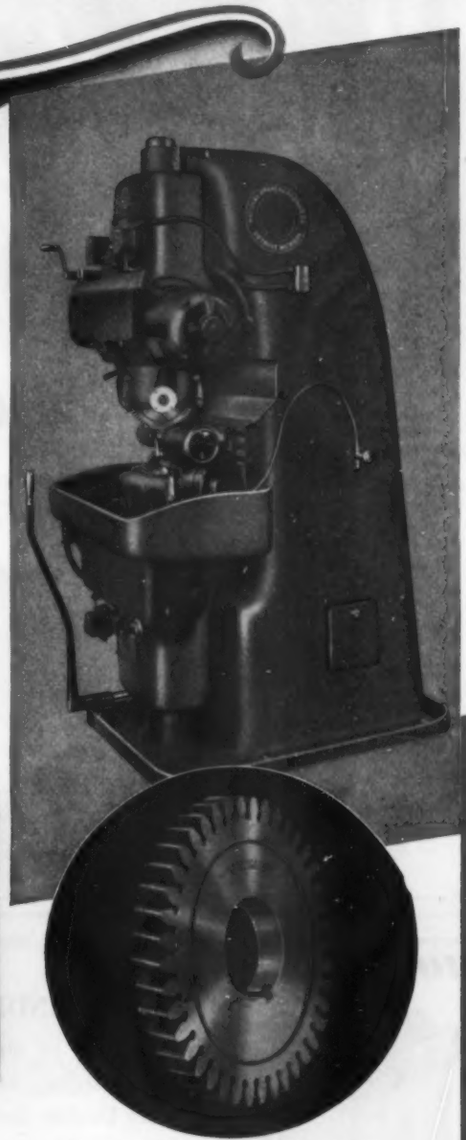
The cutter is a helical gear with gashed teeth. Fast cuts at slow feed . . . resembling fly cutter work . . . are taken as the cutter runs in mesh with the work gear. Action is *cutting* . . . not burnishing. No metal is compressed to rebound in heat treatment.

Write

Write for literature on the revolutionary new Two Head Shaving Machine.



Closeup of the Two Head Machine in operation. To the left is a cluster gear which is finished at one setting on this machine — in 20 to 40 seconds.



The Red Ring Two Head Gear Shaving Machine. Inset is the gashed tooth cutter.

Patents issued and pending: 1,989,650; 1,989,651; 1,989,652.

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These hollow screws of Chrome-Molybdenum help *modernize* machine design. They make possible more compact constructions. They aid in attaining flush surfaces, unbroken contours, narrower flanges, tighter joints. Their strength permits use of smaller sizes than formerly were required. Test these advantages with *samples* to your specifications.

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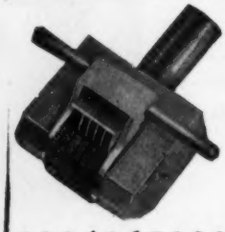
Automatic
NUMBERING HEADS



Built to "Noblewest" precision standards these numbering heads can be used to number both flat and round objects. Furnished with any size numbers or letters, also to mark in duplicate or triplicate if desired. Operated by hand or machine.

Write for catalog describing our complete line of marking devices—used by leading manufacturers everywhere.

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THE NOBLE & WESTBROOK MFG. CO.
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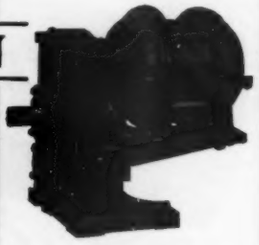
SPEED REDUCERS
Efficient—Durable—Compact

Equipped with Timken Bearings and Helical Gears. Made in sizes for motors from ¼ to 15 hp. Ratio from 2½ to 1 to 1014 to 1.



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MEASURE lengths, volumes, speeds, production . . . with Veeder-Root Counters.

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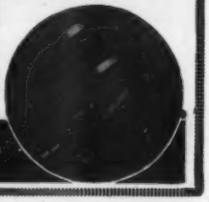

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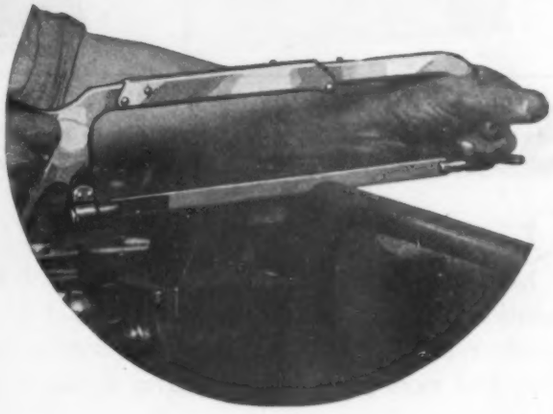

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All the flowery speeches, sensational claims regarding the merits of any tool are worthless unless that tool can stand up "under fire." Atkins Silver Steel Hacksaw Blades for 11 years have lead in hacksaw cutting under strenuous factory conditions.

For instance: A piece of 3140 S.A.E. die block steel 5⅛" x 4½" was cut in 6 minutes with a 14" x 1¼" .065 ga. 4 tooth Atkins Silver Steel Power Blade with only .001" variation in thickness from end to end.

That's why Atkins guarantees its famous Blue End Hacksaw Blades, for both power and hand use, to cut more metal . . . faster . . . easier and better than any hacksaw blade on the market.

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ATKINS *Silver Steel* SAWS

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HIGH-POWERED
PRECISION SURFACE GRINDER

Saves 9 hours-

"We secure a much more accurate slide, and are doing a job in one hour which previously took ten hours of productive time."

QUOTATION above comes from the user of a Mattison Precision Surface Grinder. Slide mentioned is cast iron—previously planed and hand-scraped. Now Mattison grinding saves time and money, provides a better finish, and eliminates scraping entirely.

The high power, speed and ruggedness of the Mattison Precision Surface Grinder, together with the accuracy and fine finish of its work, increase production and reduce costs.

Send us your blue prints or samples of work for production estimates.

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WALKER ROTARY SURFACE GRINDERS

—for profitable surface grinding on a wide range of work.

A high production cost-cutter, featuring ample power, rigidity and accuracy. Quick adjustments provided assure ability to handle a wide range of work economically.

Set-up time reduced to a minimum through the use of Walker Magnetic Chuck.

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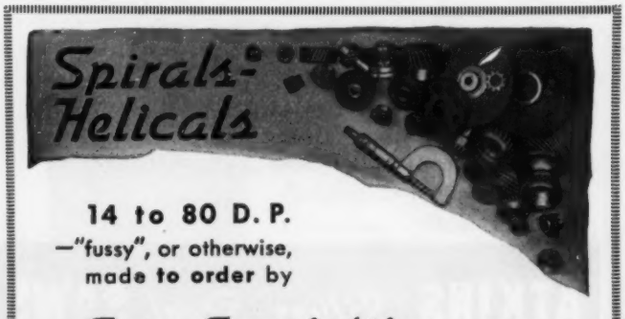

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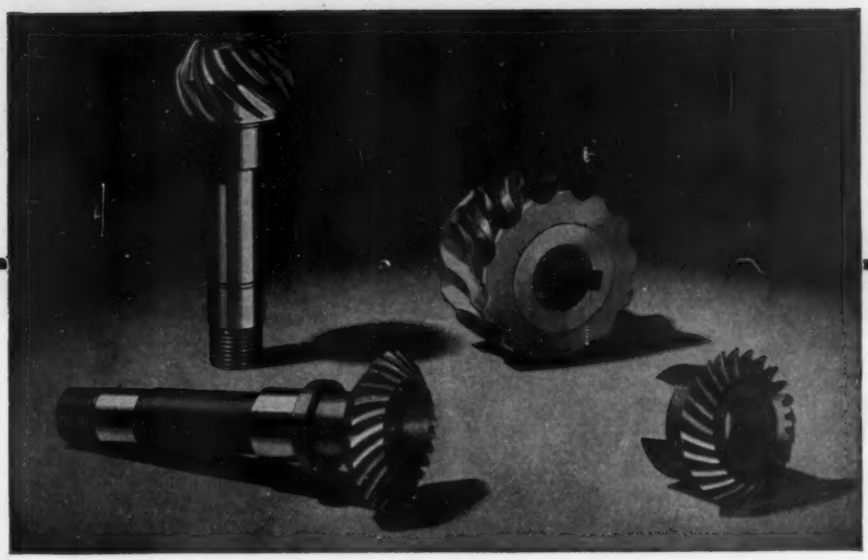

These gears are manufactured in our plant for a prominent manufacturer of Portable Electrical Tools.

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An *Efficient* Engineering Gear Service

Unsurpassed manufacturing facilities, backed by more than thirty years' successful experience, enable us to produce gears of any type, in any quantity, precisely according to specifications. But we render an additional service which is often far more valuable to our customers.

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Perhaps we can do as much for you. Send us your blue prints and specifications.

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Spur - Helical - Bevel - Worms - Screws - Racks
Gear Hobbing - Thread Milling - Broaching

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All sizes. Every description. Operating Machinery for Bridges, etc. "Lea Simplex" Cold Metal Saws

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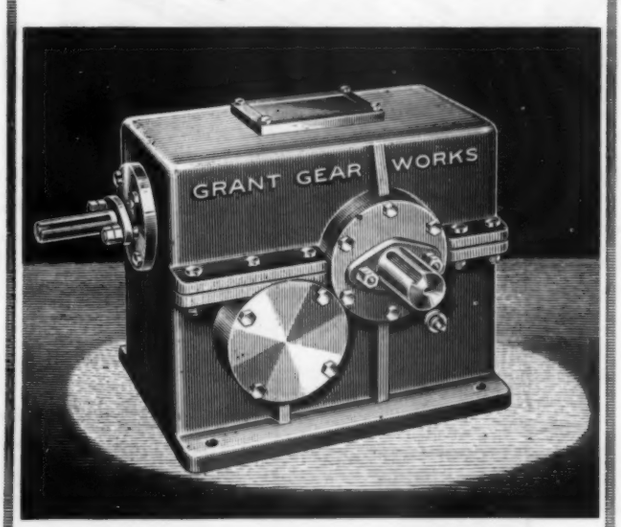
Grant Speed Reducers



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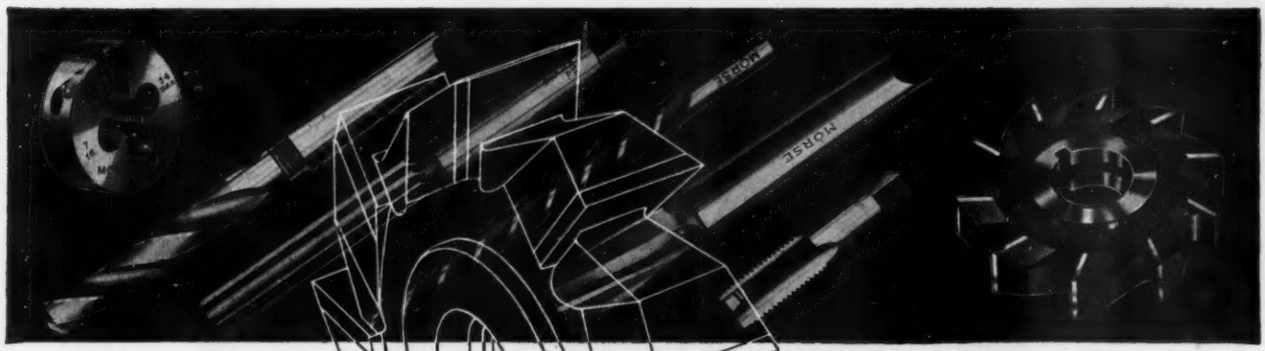
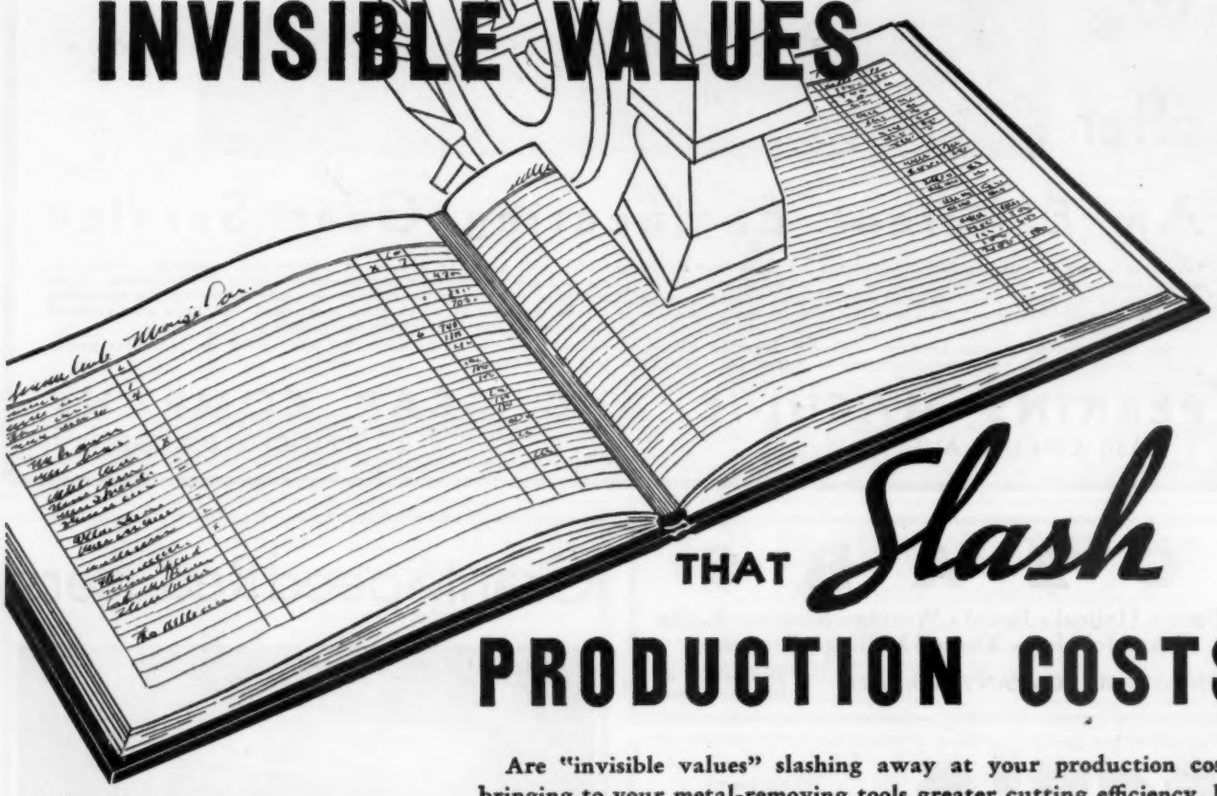


INVISIBLE VALUES



THAT *Slash* PRODUCTION COSTS

Are "invisible values" slashing away at your production costs, bringing to your metal-removing tools greater cutting efficiency, less breakage, longer time between resharpening?

They are if you use Morse Tools. **The "invisible values" are Morse Extra Values — hidden superiorities in every tool that bears the Morse trade mark. In putting them there, years of manufacturing experience play a part. So does carefully-controlled heat treating. Unusually accurate grinding. Step-by-step inspection.**

Do you have doubts about a difference between leading brands of metal-removing tools? Then let Morse extra values prove themselves in your own shop. The Morse laboratory, with many years of tool engineering experience, will co-operate on any problem.

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Fully Automatic Production Hack Sawing Machines in two sizes equipped with either normal service automatic bar push-up or with special "heavy duty" automatic bar push-up for extremely heavy work.

All ball-bearing Heavy Duty High Speed Hack Sawing Machines.

Dry cutting, general utility Shop Saws, at extremely low prices.

The largest capacity universal metal cutting **Band Saw Machine.**

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SELECT THE RIGHT WHEEL
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"It is without question the finest Surface Grinder we have ever used.

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These reports came unsolicited from users of Grand Rapids Hydraulic Feed Surface Grinders.

Over 50% of our present record-breaking business coming from satisfied users.

Surely, every Surface Grinder user should investigate the earning capacity of these machines.

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Much has been accomplished in the old year, there is much to do in the new year and in the process of feeling our way along the road to normal business conditions we are thankful to the many thousands of users of STERLING WHEELS to whom a good product and good service have appealed and whose loyalty has enabled STERLING to develop new wheels, new segment units and new products designed to reduce the operating costs and improve the product of its many customers.

It is with a pledge of continued quality products and service that we enter the new year with every good wish for the success of our many friends.

A Merry Christmas and A Happy New Year

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Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustments in each tap-holder, if required.

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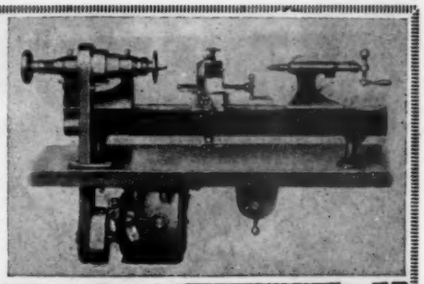
6 Sizes with complete equipment. Stark Motor Drive Unit for any bench lathe. Original and best under-bench drive. Spring Bind Lathe for very accurate and fast manufacturing of small parts. 5 Spindle Diamond Drills. Auto Turret Heads, 1 to 3 Spindle Sensitive Upright Drills. Upright Tapping Machine for clock and instrument work, fast and accurate. Chucks. Diamond Die Polishers. Collets. Special Precision Tools.



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Since 1862

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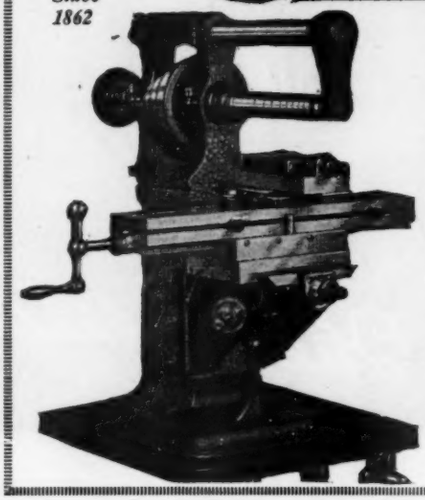

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Plain or Spiral, with Stark Motor Drive Unit or counter-shaft. 18" table swings 6" diameter. Wide slides. Main spindle has Stark 3" and 45° angle compression tool steel bearings front and rear. Collet capacity ¾". Index Centers best of their type.

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Originators of the American bench lathe

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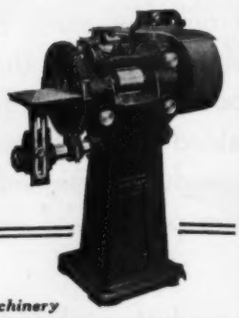
This handy, useful combination disc grinder, polishing wheel and belt surfacer offers wide utility in shops where power and space are limited. It can be easily converted into a buffing machine or light snagging grinder and still further extend its usefulness.

Sturdy in construction and of modern design throughout the Type "R" insures economical operation, long life and low maintenance.



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A Rawhide Gear or Pinion in any drive will absorb destructive vibration and chatter, will end gear "grinding," will silence grating. It will deliver as much power as an equivalent gear of iron or brass, will take all the wear and still out-wear metal. All sizes, all shapes, all pitches on short notice.

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1252 Elston Avenue
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Chicago Rawhide GEARS and PINIONS

GRINDING
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VERTICAL AND HORIZONTAL TYPES—⅛ TO 2 H.P.

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AMERICAN GAS FURNACE CO. — PIONEERS IN GAS HEATING FOR 75 YEARS

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For Every
INDUSTRIAL REQUIREMENT

American Gas Furnace Company
Elizabeth, N. J.

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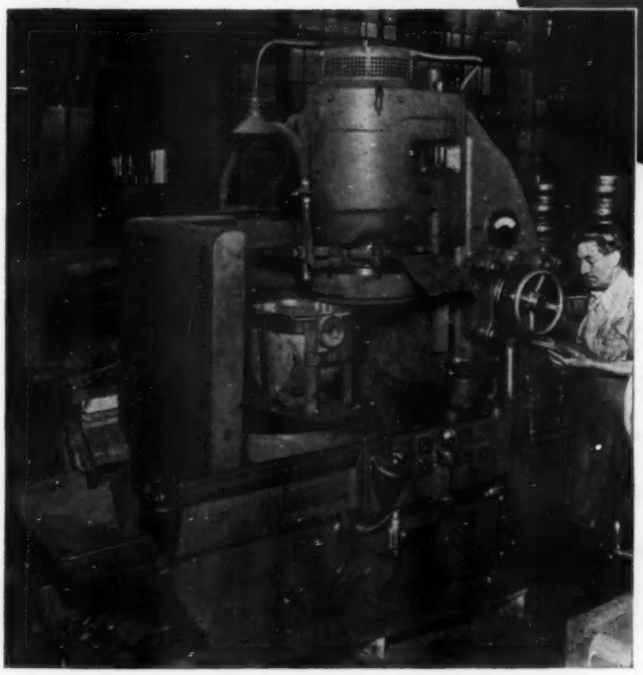


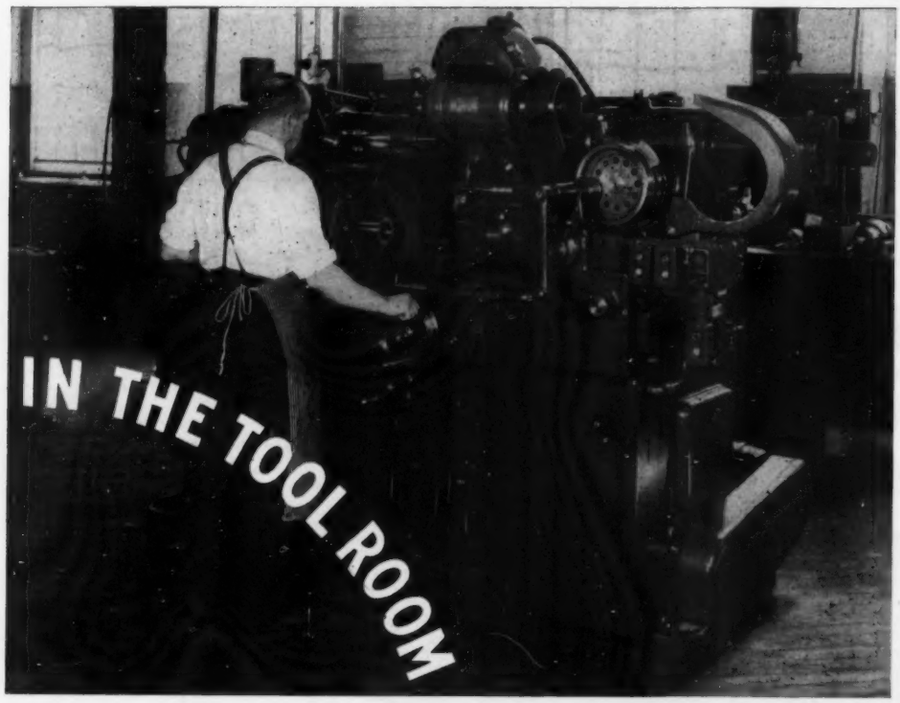
Production doubled on Meter Bodies by Blanchard Grinding semi steel to .002"

BLANCHARD

The illustration shows a No. 18 Blanchard grinding one surface flat to within .002" on a 19" x 14" x 16" high semi-steel meter body. Stock removed 1/16". Production 6 per hour. This is double the quantity formerly secured by a planing operation. If you have flat surfaces to be machined let us suggest what can be done with a Blanchard. Send sample pieces or blueprints. No obligation.

THE BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.



2-Spindle 16-A Bryant Grinder in tool room, grinds work from small size up to 15½" swing.

BRYANT 16-A

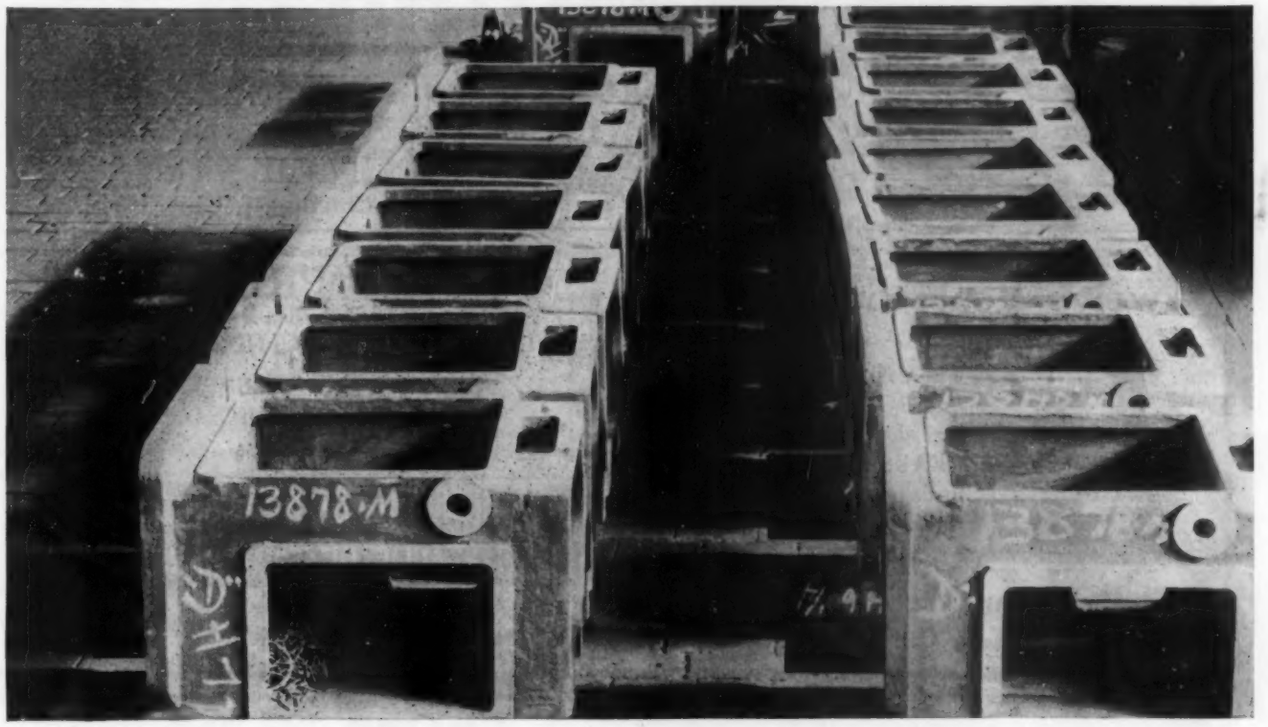
The Bryant 16-A Two-Spindle Hole and Face Grinder is a double-purpose machine used for the finish grinding of two or more different surfaces at a single chucking of the work. The grinding wheels are used successively, the operator swinging either one into working position as desired. While this grinder is distinctly a production machine, it is also valuable for tool room equipment.

As a PRODUCTION TOOL — it has the same advantages of wheel-slide control as the Bryant Single-Spindle Hole Grinders, which insure a maximum output for internal grinding.

As a PRECISION TOOL — grinding two or more surfaces at a single holding of the work insures a high degree of accuracy, as the surfaces so finished must be true and concentric with each other.

BRYANT CHUCKING GRINDER CO., Springfield, Vermont, U. S. A.

Special Machines on a
PRODUCTION BASIS

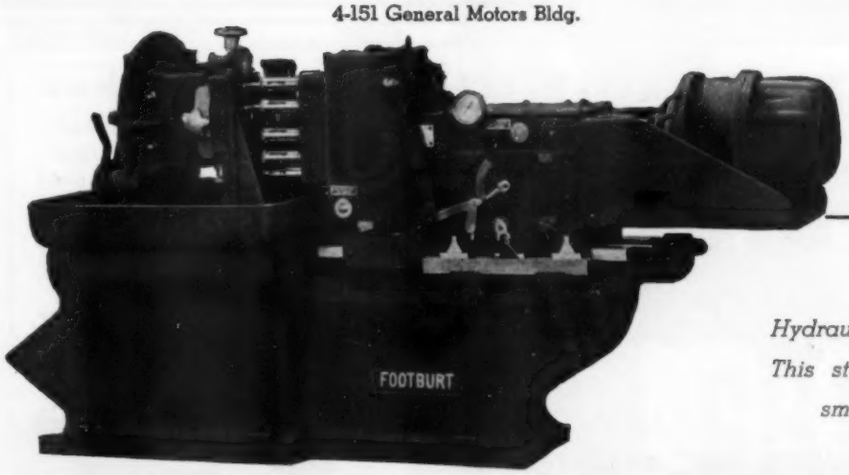


FOOTBURT unit type construction in way drilling and tapping machines makes many manufacturing economies possible. Cam Feed, Hydraulic Feed and Lead Screw Tapping units are built in lots on a production basis—the savings are reflected in prices. The unit design also aids in making early deliveries.

THE FOOTE-BURT COMPANY, CLEVELAND, OHIO

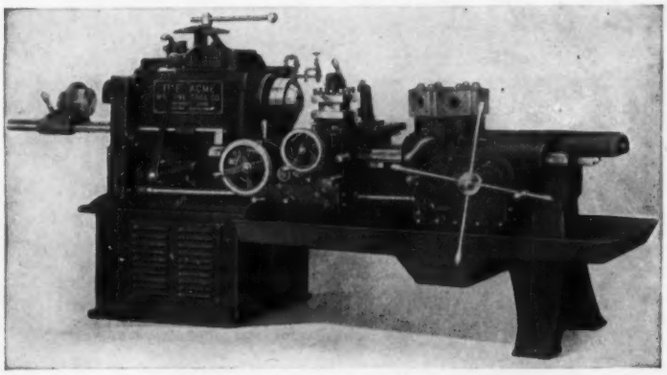
Detroit Office
4-151 General Motors Bldg.

Chicago Office
565 Washington Boulevard



FOOTBURT

Hydraulic feed way drilling machine. This style unit is furnished in two smaller and one larger size.



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Way Type UNIVERSAL TURRET LATHE

A powerful rigid machine for a wide range of accurate bar and chuck work.

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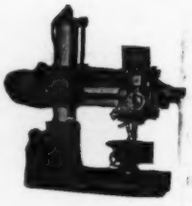
Cincinnati, Ohio

Twelve Years Satisfaction



The Carlton All Ball Bearing Radial Drill pleases its users. Has done so for TWELVE YEARS and will continue to do so. Learn all its features and you'll see why.

The Carlton Machine Tool Co.
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LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.
NOW AND ALWAYS OF
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SELF-OILING, ALL-GEARED DRILLERS and HYDRAULIC INTERNAL HONERS

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AUTOMATIC DRILLING AND TAPPING MACHINES
KINGSBURY MACHINE TOOL CORP.
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Originators of the Automatic Drilling Head Unit

LATHES { TOOL ROOM / PRODUCTION
Special Machinery • Founders
The SPRINGFIELD MACHINE TOOL COMPANY
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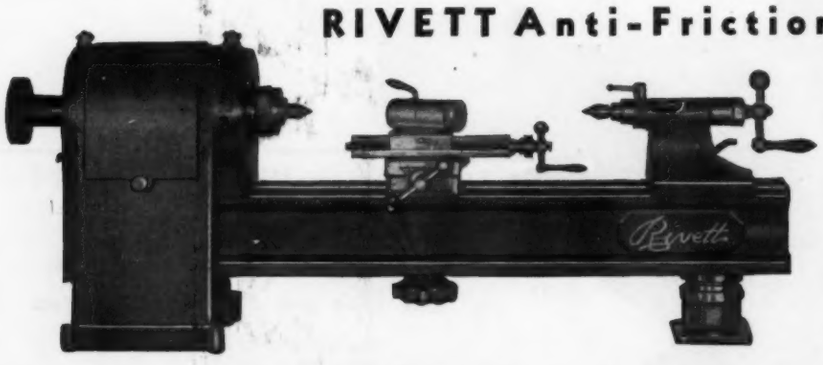
(Automatic and Semi-Automatic)
LELAND GIFFORD CO.
WORCESTER, MASS.

GOSS and DE LEEUW
MULTIPLE SPINDLE
CHUCKING MACHINES
Two, Four, Five Spindles • Work and Tool Rotating Types
GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

RIVETT Anti-Friction Bench Lathes



The earning power of an anti-friction bearing lathe with Rivett Speed Box Motor Drive may be three times that of counter-jackshaft driven unit.

Spindle is trouble proof.
Speeds: Ball Bearing, 200–4600 r.p.m.
Roller Bearing, 100–2300 r.p.m.
Motor runs continuously.
Endless driving belt replaceable in one minute.
Speed Box gearing and clutch splash lubricated.
Automatic brake stops spindle instantly.

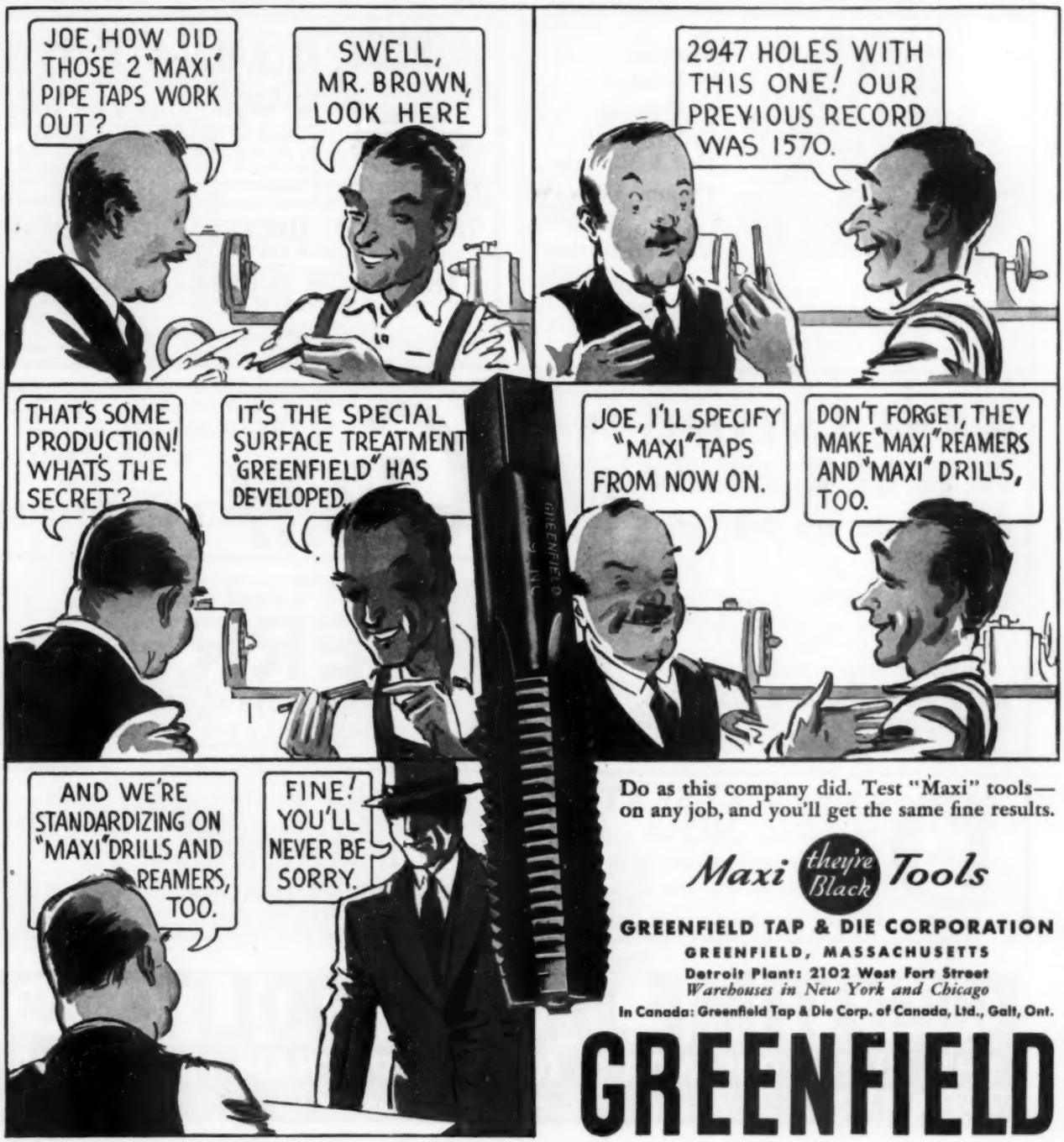
Double production and no lost time are assured.

Bulletin 505-BB and 505-RB

RIVETT LATHE & GRINDER INC. BRIGHTON, MASS.

MAXI TAPS TOP PREVIOUS RECORD BY 87%

A True Story from North Carolina


JOE, HOW DID THOSE 2 "MAXI" PIPE TAPS WORK OUT?
SWELL, MR. BROWN, LOOK HERE
2947 HOLES WITH THIS ONE! OUR PREVIOUS RECORD WAS 1570.
THAT'S SOME PRODUCTION! WHAT'S THE SECRET?
IT'S THE SPECIAL SURFACE TREATMENT "GREENFIELD" HAS DEVELOPED.
JOE, I'LL SPECIFY "MAXI" TAPS FROM NOW ON.
DON'T FORGET, THEY MAKE "MAXI" REAMERS AND "MAXI" DRILLS, TOO.
AND WE'RE STANDARDIZING ON "MAXI" DRILLS AND REAMERS, TOO.
FINE! YOU'LL NEVER BE SORRY.
GREENFIELD

Do as this company did. Test "Maxi" tools—on any job, and you'll get the same fine results.

Maxi (they're Black) *Tools*

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FOR OVER A QUARTER OF A CENTURY

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THE PIONEER MANUFACTURER OF

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MODEL 35 ACME

Modern Threading Machines adapted to high production work. Can be equipped with either tangent or hobbed die heads. Write for bulletin.

Also builders of Acme Bolt—Rivet and Forging Machines.

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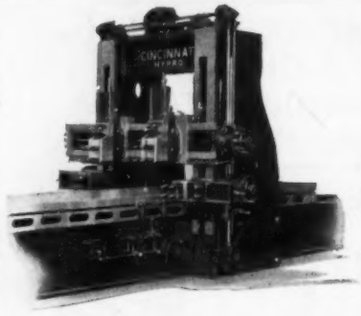
THREADING MACHINES



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BETTER-MADE
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AT LOWER COST
24 Styles -- 95,000 Sizes
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THOMPSON SURFACE GRINDERS
COMPLETE HYDRAULIC

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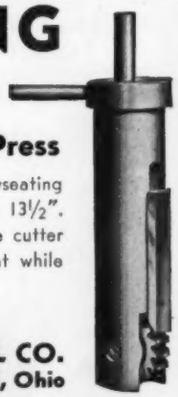
KEYSEATING MILLER



Designed for the Drill Press

Bring the tool to the job. These Keyseating Millers Range in Diameter from 7/16" to 13½". They fit in the holes being keyseated. The cutter in the tool is rotary and mills the keyseat while sliding down thru the hole.

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For production or job work—fast and accurate on a wide range of slotting, keyseating, splining and grooving. Work centers itself—requires no skilled operator. Write for catalog.

Giant KEYSEATERS

MITTS & MERRILL
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17 STYLES AND SIZES
MERRELL
PIPE THREADING for BETTER threads MACHINES
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DAVIS KEYSEATER

This low cost machine will handle any keyseating job in the shop up to 1½ in.

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SELF OPENING

TAPS
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THE NILES TOOL WORKS CO. | THE PUTNAM MACHINE CO.

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DIE & MOLD COSTS . . . . *Are Too High!*

Die-casting and small drop forging dies, multiple and single cavity molds etc., can be reproduced by Gorton Duplicators at *half the cost* of the ordinary methods — and with better accuracy. Send for Duplicator Bulletin.

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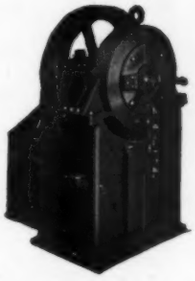

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SWAGING MACHINE — with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Modern Art of Swaging."

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FEEDS
AUTOMATIC EQUIPMENT
THE V&O Press Co.
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If you don't find what you are looking for in the Where-to-Buy Directory—write us.

AMERICAN MACHINIST
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HYDRAULIC MACHINERY SINCE 1907
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HIGH SPEED
FORGING & FORMING
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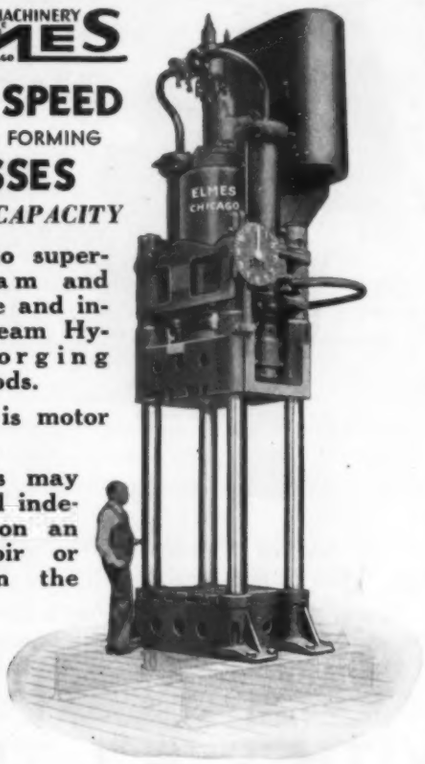
750 TONS CAPACITY



Designed to supersede Steam and Drop Forge and incapable Steam Hydraulic Forging press methods.

The press is motor driven. . . .

The pumps may be mounted independently on an oil reservoir or directly on the press.

Speeds Up To 40 Strokes Per Minute

Model 4277

CHARLES F. ELMES ENGINEERING WORKS
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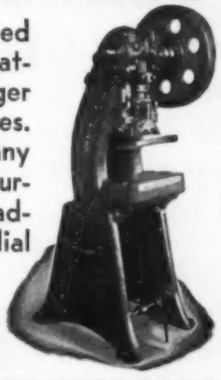
RECLINABLE POWER PRESSES

Plain or back geared—equipped with repeatable and non-repeatable clutch, up and down finger guard and many other features. These presses are built in many different sizes and can be furnished with our patented adjustable stroke, roll feeds or dial feeds.



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For Your RIVETING

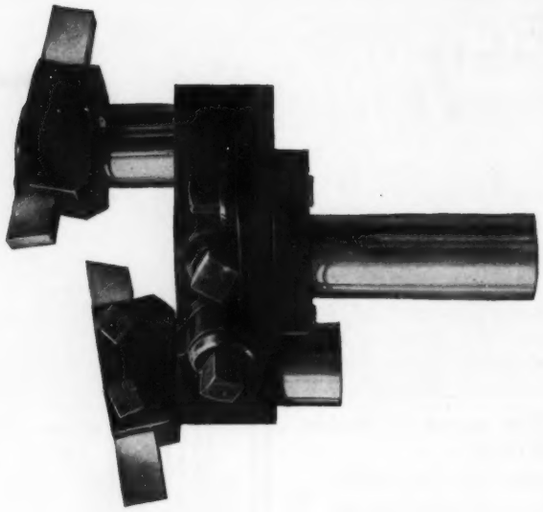
LINLEY NOISELESS ROTARY RIVET SPINNING MACHINES

Assure Peak Production and Lower Maintenance. Rigid and Powerful. Bench and Floor Types. Motor or Belt Driven. There is a Linley machine for every riveting job.

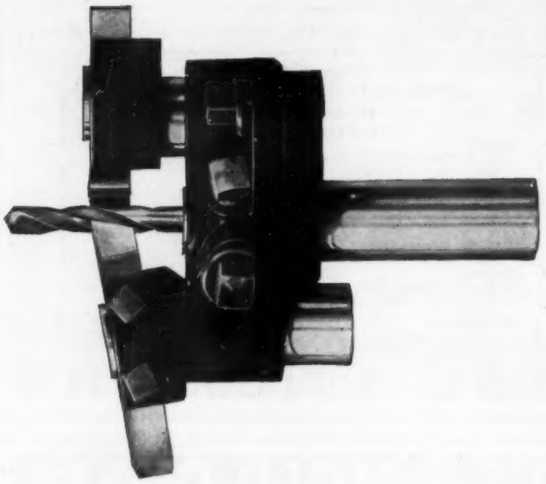
Send samples of your work for riveting, cost of equipment, and true estimates on production.

"Built to Last—Riveting Fast"

LINLEY BROTHERS CO.
581 Fairfield, Ave.
BRIDGEPORT, CONN.



Used as a balanced turning tool—two cutters—one set in advance of the other—turning two diameters if needed. An ideal combination for removing metal fast.



Drilling is readily accomplished at the same time the piece is being turned—or a piece can be centered while turning to provide perfect concentricity. Drill can be centered accurately.

WITH R & L TURNING TOOLS *you'll get* Closer Accuracy, Better Finish, Lower Costs

Eight months ago we ran our first advertisement for R & L Turning Tools. A few readers were interested enough to write for more information, and we sold a tool here and there. The weeks rolled around and we continued to tell our story. Either we told it better or repetition began to break down the sales resistance every new product must encounter. Whatever the reason, the results have been entirely satisfactory to all concerned.

R & L Turning Tools are now in use in dozens of shops. We've filled many repeat orders. We were practically forced to bring out a smaller tool for use with No. 00 B S automatics. And we have received many commendatory letters from users telling about R & L Tools on various types of work.

Which all goes to prove that R & L Turning Tools really do save money by saving time, by improving accuracy and finish, by reducing tool investment. If you don't know about R & L Tools we believe it will pay you to investigate.

R & L TOOLS

NICETOWN, PHILADELPHIA, PA.

Light Duty Threading

For fine pitch threading, and for difficult or unusual threading work, Geometric offers the Style C Self-Opening Die Head. Recently redesigned for greater simplicity, this tool is our answer to the problems of cutting short, fine pitch threads without stripping, or threading castings of unusual shape while maintaining accurate and uniform thread length. Incorporated in the tool are the regular Geometric features of hardened and ground working parts, special alloy steels, easy shoulder threading—and the skill and knowledge of over forty years of experience.

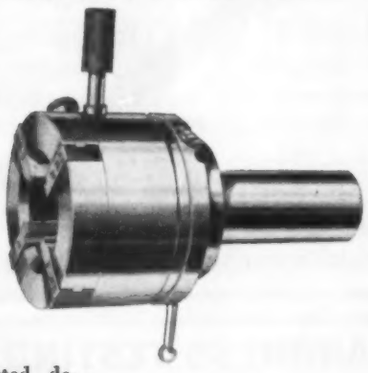
Because the Style C Head is designed to cut reasonably fine pitches on large diameters, important economies are made with the use of light-duty Chasers. Thus, a 2¼″ C Head takes Chasers of the same size as the 1″ D Head—representing a saving of about 50% on the cost of Chasers.

Twenty-three different styles and sizes are carried in stock, covering a range of diameters from ⅜″ to 6″ and cutting pitches of 8 TPI or finer. In addition, a variety of special Heads, in sizes from 5/16″ to 10″, have been made over a period of years. Special shanks and adaptations can be made for special jobs. Standard Style C heads are available in three types:

Inside Trip Type—Where the length of thread must be accurately repeated in spite of the irregular shape of the work, the adjustable stop within the bore of the tool contacts the end of the work to trip the Head.

Outside Trip Type—To avoid stripping of short, fine pitch threads, all stress in tripping is taken by a lever contacting a stop on the machine.

Pull-Off Trip Type—For threads of moderate length the dependable pull-off trip is used. Similar to the standard Style D Die Head.



This new catalog folder, just printed, describes in detail the Geometric Style C Die Heads. Send for your copy now—use coupon.

The Geometric Tool Co.

New Haven, Connecticut

Specialists in production threading tools since 1895

THE GEOMETRIC TOOL COMPANY
5 Valley Street, New Haven, Conn.
Please send me, without obligation, a copy of the new folder describing the Geometric Style C Die Heads.

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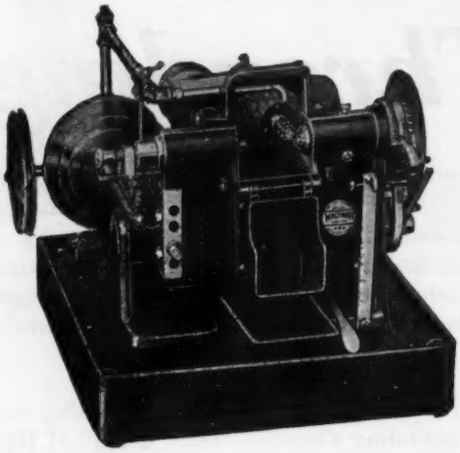
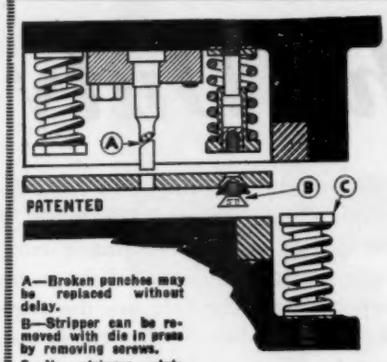


WALTHAM PINION CUTTERS

FOR ACCURACY AND HIGH PRODUCTION

These results are obtained by careful construction and up-to-date design that reduces unproductive time to a minimum. The 1½ in. machine will handle work from the size of watch pinions to 32 pitch gears. A magazine feed for the work can generally be used for pinions either hollow or staffed, and with it the work changing time is only a fraction of a second. The 4 in. machine will cut up to 16 pitch and can be furnished with an individual motor drive.

WALTHAM MACHINE WORKS
HIGH STREET . . . . . WALTHAM, MASS.



A—Broken punches may be replaced without delay.
B—Stripper can be removed with die in press by removing screws.
C—No stripper plate required for stripping scrap — Strippits alone will strip it.

STRIPPIT

The most dependable and economical stripping device made.

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THE STRIPPIT CORPORATION
1559 Niagara St. Buffalo, N. Y.
Also Wales Adjustable Hole Punching Dies.

GRANT

RIVETERS—PIONEERS in their line—Head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

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Helical Taper Pin Reamer

Made from selected steel by the most modern processes. Also Chucking and Rose Reamers. Special Taper Reamers. New Low Prices — Circular and price list No. 2 on request

For finishing holes for taper pins economically
BETTER
FASTER
CHEAPER

HOLMAN REAMER CO., Manchester, Conn.

Famous for quality of threads they produce, long life of chasers and all-around dependability.

Following literature available:
Bulletin on H & G General Purpose Die Heads.
Bulletin on new Insert Chaser Type of Die Head.
Bulletin on H & G Threading Machines.
See our advertisement on page 265 of September 11th American Machinist

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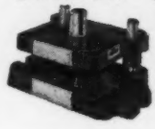
San Francisco: A. H. Coates Company, 1142 Howard St.

DANLY PRECISION DIE SETS



DANLY ALL-STEEL SETS • DANLY COMMERCIAL SETS • DANLY DIE MAKERS' SUPPLIES

7 Danly Warehouses Provide 24-Hour Service for 85% of All Metal Fabricating Plants.

DANLY MACHINE SPECIALTIES, INC.
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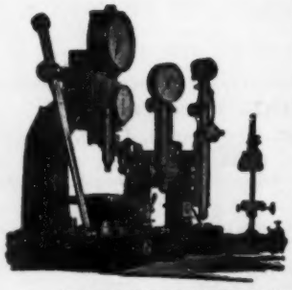

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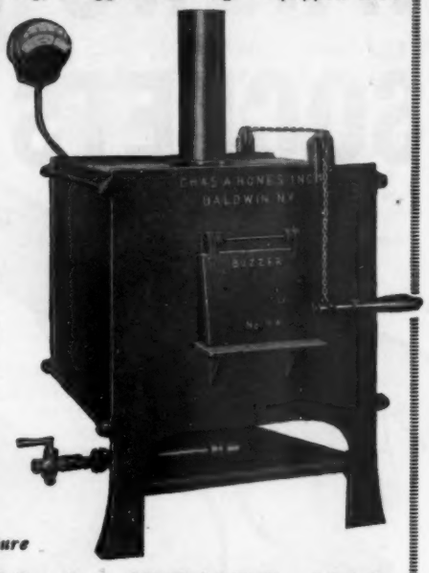

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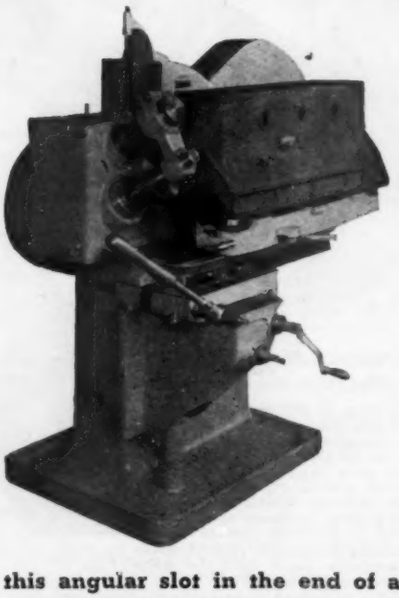

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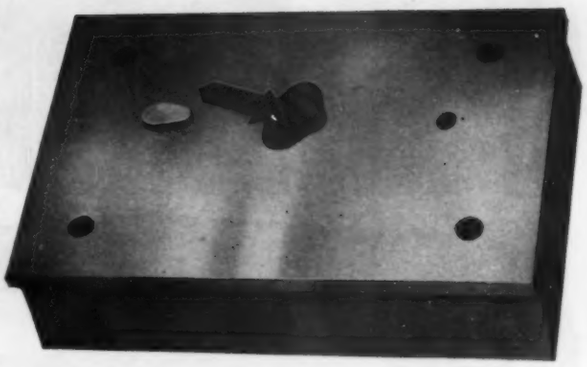
Cut Labor Costs on Blanking Dies

with the Hanson-Whitney Universal VERTICAL *Tool and Die Shaper . . .*



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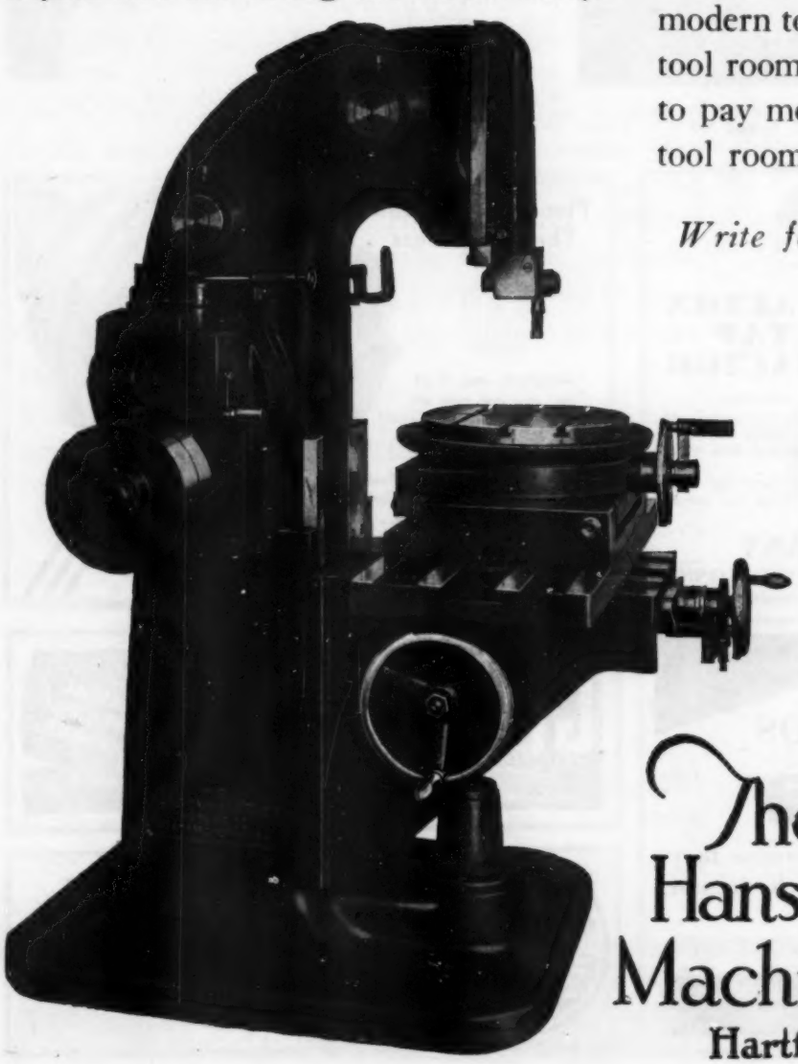

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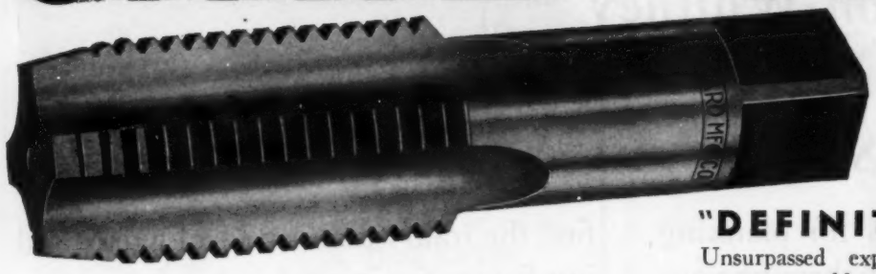

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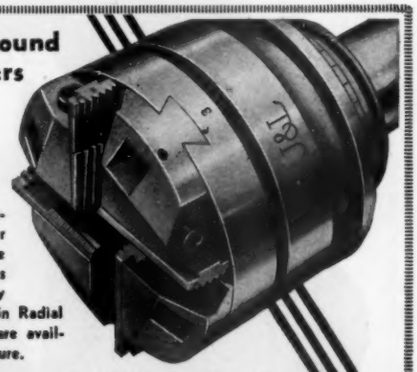

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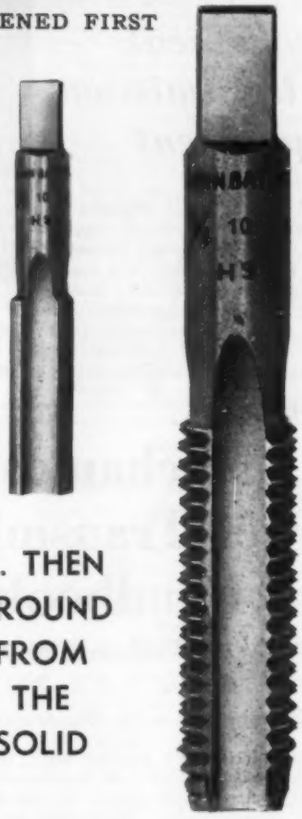

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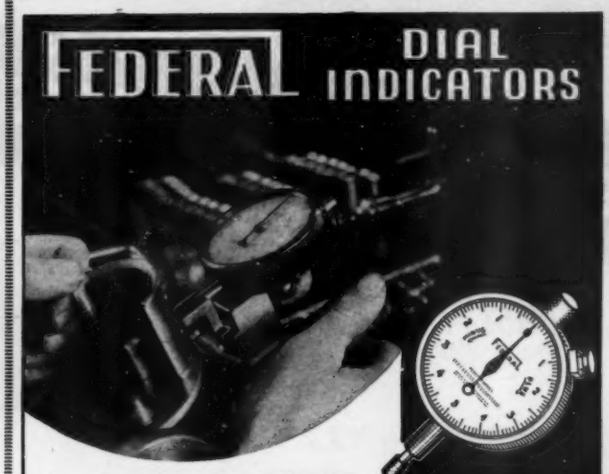

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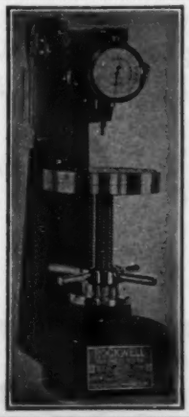

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Mattison Machine Works, Rockford, Ill.
Springfield Machine Tool Co., Springfield, Ohio

CENTERING MACHINES
Hanson-Whitney Machine Co., Hartford, Conn.
Pratt & Whitney Co., Hartford, Conn.

CENTERS, LATHE
Ready Tool Co., Bridgeport, Conn.

CHECKS, METAL, TIME AND TOOL
Noble & Westbrook Mfg. Co., Hartford, Conn.

CHESTS, Tool
Lufkin Rule Co., Saginaw, Mich.

CHUCKING MACHINES
Bullard Co., Bridgeport, Conn.
Goss & De Leew Machine Co., New Britain, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Kingsbury Machine Tool Corp., Keene, N. H.
New Britain-Gridley Machine Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland, Ohio

CHUCKS, Automatic and Quick Action
Errington Mechanical Laboratory, Staten Island, N. Y.

CHUCK CYLINDERS, Air
Tomkins-Johnson Co., Jackson, Mich.

CHUCKS, DRILL AND TAP
Errington Mechanical Laboratory, Staten Island, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CHUCKS, FULL FLOATING
Errington Mechanical Laboratory, Staten Island, N. Y.

CHUCKS, LATHE
Bullard Co., Bridgeport, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Walker Co., O. S., Worcester, Mass.

CHUCKS, VERT. BORING MILL
Bullard Co., Bridgeport, Conn.

CLAMPS, MACHINISTS
Armstrong Bros. Tool Co., Chicago, Ill.
Lufkin Rule Co., Saginaw, Mich.

CLEANER'S COMPOUND
Oakite Products, Inc., New York, N. Y.

CLUTCHES, FRICTION
Johnson Machine Co., Carlyle, Manchester, Conn.

COLLETS
Brown & Sharpe Mfg. Co., Providence, R. I.
Union Twist Drill Co., Athol, Mass.

COLLETS & FEED FINGERS, SCREW MACHINE
Hardinge Brothers, Inc., Elmira, N. Y.

COLLETS, LATHE
Hardinge Brothers, Inc., Elmira, N. Y.
Rivett Lathe & Grinder, Inc., Boston, Mass.
Stark Tool Co., Waltham, Mass.

COMPARATORS, DIAL
Federal Products Corp., Providence, R. I.

COMPOUNDS, CUTTING, DRAWING, DRILLING, GRINDING
Oakite Products, Inc., New York, N. Y.
Gulf Refining Co., Pittsburgh, Pa.

COMPOUNDS, RESIN
Bakelite Corp., New York, N. Y.
Formica Insulation Co., Cincinnati, Ohio

COMPOUNDS, TEMPERING & CASE HARDENING
Oakite Products, Inc., New York, N. Y.

CONTRACT WORK
Brown & Sharpe Mfg. Co., Providence, R. I.
Franklin Machine Co., Providence, R. I.
Hartford Special Machinery Co., Hartford, Conn.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kent-Owens Machine Co., Toledo, Ohio
Waltham Machine Works, Waltham, Mass.

COUNTERBORES
Morse Twist Drill & Machine Co., New Bedford, Mass.

COUNTERS & COUNTING MACHINES
Veeder-Root, Inc., Hartford, Conn.

COUNTERSHAFTS
Rivett Lathe & Grinder Inc., Boston, Mass.

COUNTERSINKS
Morse Twist Drill & Machine Co., New Bedford, Mass.

COUPLINGS, FLEXIBLE
Cullman Wheel Co., Chicago, Ill.

CUTTERS, DIE SINKING
Tomkins Johnson Co., Jackson, Mich.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Machine Co., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTERS, KEYSEATER
Davis Keyseater Co., Rochester, N. Y.
National Machine Tool Co., Cincinnati, Ohio

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co. (Div. of Union Twist Drill Co.), Derby Line, Vt.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

CUTTING APPARATUS, Oxygen, Acetylene
Air Reduction Sales Co., New York, N. Y.

CUTTING-OFF MACHINES
Atkins, E. C. & Co., Indianapolis, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Landis Machine Co., Waynesboro, Pa.

DEALERS, MACHINERY (see Searchlight Section)
Bernstein & Co., G. M., Chicago, Ill.
Cincinnati Machinery & Supply Co., Cincinnati, Ohio
Eastern Machinery Co., Cincinnati, Ohio
Emerman & Co., Louis E., Chicago, Ill.
Howarth Machinery Co., C. C., Detroit, Mich.
Hill Clarke Machinery Co., Chicago, Ill.
Hyman & Sons, Jos., Philadelphia, Pa.
Indianapolis Machy. & Supply Co., Indianapolis, Ind.
Industrial Machinery Co., Indianapolis, Ind.
Interstate Machinery Co., Chicago, Ill.
Iroquois Mchy. Co., Buffalo, N. Y.
Marr-Galbreath Machy. Co., Pittsburgh, Pa.
Miles Machinery Co., Saginaw, W. S., Mich.
Monarch Machinery Co., Philadelphia, Pa.
Morey & Co., Inc., New York City, N. Y.
Morris Machinery Co., Newark, N. J.
Motor Repair & Mfg. Co., Cleveland, Ohio
O'Brien Machinery Co., Philadelphia, Pa.
Ott Machinery Sales Co., Detroit, Mich.
Riverside Machy. Depot, Detroit, Mich.
Simmons Mach. Tool Corp., Albany, N. Y.
Standard Machinery & Supply Co., Inc., Boston, Mass.
Strong, Carlisle & Hammond Co., Cleveland, Ohio
Sun Machinery Co., Inc., Newark, N. J.

DEMAGNETIZERS
Walker Co., O. S., Worcester, Mass.

DIAMONDS, Industrial
Gilmore & Co., F. F., Boston, Mass.

DIE MAKERS' SUPPLIES
Baumbach Mfg. Co., E. A., Chicago, Ill.
Danly Machine Specialties Co., Inc., Chicago, Ill.

DIE-MAKING MACHINES
Gorton Machine Co., Geo., Racine, Wis.
Oliver Instrument Co., Adrian, Mich.

DIE SINKING MACHINES
Cincinnati Milling Machine Co., Cincinnati, Ohio

DIE SETS
Baumbach Mfg. Co., E. A., Chicago, Ill.
Danly Machine Specialties Co., Inc., Chicago, Ill.

DIE STRIPPERS
Strippit Corp., Buffalo, N. Y.

DIES, Adjustable
Greenfield Tap & Die Corp., Greenfield, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.

DIES, ADJUSTABLE AND SELF OPENING
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, Staten Island, N. Y.
Geometric Tool Co., New Haven, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.

DIES, Perforating
Strippit Corp., Buffalo, N. Y.

DIES, ROUND ADJUSTABLE
Butterfield & Co. (Div. of Union Twist Drill Co.), Derby Line, Vt.
Card Mfg. Co., S. W. (Division Union Twist Drill Co.), Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DIES, Sheet Metal and Sub-Press (see Contract Work)

DIES, Steel Marking
Noble & Westbrook Mfg. Co., Hartford, Conn.

DIES, Thread Rolling
Bath & Co., Inc., John, Worcester, Mass.

DIVIDING HEADS
Scherr Co., George, New York, N. Y.

DOGS, Lathe and Milling Machines
Armstrong Bros. Tool Co., Chicago, Ill.
Ready Tool Co., Bridgeport, Conn.

DRESSERS, Grinding Wheel
Desmond-Stephan Mfg. Co., Urban, Ohio
Gilmore & Co., F. F., Boston, Mass.

DRILLING AND TAPPING HEADS, Multiple
Errington Mechanical Laboratory, Staten Island, N. Y.

DRILLING MACHINES, Automatic & Semi-Automatic
Barnes Drill Co., Rockford, Ill.
Baush Machine Tool Co., Springfield, Mass.
Kingsbury Machine Tool Corp., Keene, N. H.
National Automatic Tool Co., Richmond, Ind.

DRILLING MACHINES, Gang
Barnes Drill Co., Rockford, Ill.
Foote Burt Co., Cleveland, Ohio

DRILLING MACHINES, Heavy Duty
Barnes Drill Co., Rockford, Ill.
Consolidated Machine Tool Corp., Rochester, N. Y.
Foote Burt Co., Cleveland, Ohio

DRILLING MACHINES, Horizontal
Kingsbury Machine Tool Corp., Keene, N. H.

DRILLING MACHINES, Automatic

DRILLING MACHINES, Radial
American Tool Works Co., Cincinnati, Ohio
Carlton Machine Tool Co., Cincinnati, Ohio

DRILLING MACHINES, Sensitive
Kingsbury Machine Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.

DRILLING MACHINES, Turret
Kingsbury Machine Tool Corp., Keene, N. H.
National Automatic Tool Co., Richmond, Ind.

DRILLING MACHINES, Upright Multiple Spindle
Barnes Drill Co., Rockford, Ill.
Consolidated Machine Tool Corp., Rochester, N. Y.
Foote Burt Co., Cleveland, Ohio
Grant Mfg. & Machine Co., Bridgeport, Conn.
Kingsbury Machine Tool Corp., Keene, N. H.
National Automatic Tool Co., Richmond, Ind.
Pratt & Whitney Co., Hartford, Conn.

DRILLING MACHINES, Vertical
Barnes Drill Co., Rockford, Ill.
Foote Burt Co., Cleveland, Ohio
Leland-Gifford Co., Worcester, Mass.

DRILLS
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Center
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

DRILLS, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

DRILLS, Twist and Flat
Butterfield & Co. (Div. of Union Twist Drill Co.), Derby Line, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

END MILLS
Gammons-Holman Co., Manchester, Conn.

ENGRAVING MACHINERY
Gorton Machine Co., Geo., Racine, Wis.

FILES AND RASPS
Atkins, E. C. & Co., Indianapolis, Ind.

FILING MACHINES
Atkins, E. C. & Co., Indianapolis, Ind.
Oliver Instrument Co., Adrian, Mich.

FITTINGS, Hydraulic
Elmes Engineering Works, Chas. F., Chicago, Ill.

FLEXIBLE SHAFT EQUIPMENT
Strand & Co., N. A., Chicago, Ill.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio

FURNACES, Forging
Hones Inc., Chas. A., Baldwin, L. I., N. Y.

WHERE-TO-BUY DIRECTORY

FURNACES, Heat-Treating, Tempering and Annealing
American Gas Furnace Co., Elizabeth, N. J.
Hones Inc., Chas. A., Baldwin, L. I., N. Y.
Stark Tool Co., Waltham, Mass.

FURNACES, Soldering
Hones Inc., Chas. A., Baldwin, L. I., N. Y.

FURNITURE, Machine Shop
New Britain-Gridley Machine Co., New Britain, Conn.

GAGES, Comparator
Jones & Lamson Machine Co., Springfield, Vt.
Scherr Co., George, New York, N. Y.

GAGES, Depth
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.

GAGES, Dial
Federal Products Corp., Providence, R. I.
Randall & Stickney, Waltham, Mass.

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Pratt & Whitney Co., Hartford, Conn.

GAGES, Snap and Cylindrical
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Pratt & Whitney Co., Hartford, Conn.

GAGES, Standard
Hanson-Whitney Machine Co., Hartford, Conn.

GAGES, Thickness
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.

GAGES, Thread
Bath & Co., Inc., John, Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Co., Hartford, Conn.

GEAR BLANKS, Composition
Bakelite Corp., New York, N. Y.
Chicago Rawhide Mfg. Co., Chicago, Ill.

GEAR BURNISHING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.

GEAR CUTTING MACHINES
Adams Co., Dubuque, Iowa
Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
National Broach & Machine Co., Detroit, Mich.
Scherr Co., George, New York, N. Y.
Waltham Machine Works, Waltham, Mass.

GEAR LAPPING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
National Broach & Machine Co., Detroit, Mich.

GEAR MEASURING MACHINES
Fellows Gear Shaper Co., Springfield, Vt.
National Broach & Machine Co., Detroit, Mich.

GEAR TEMPERING MACHINES
Gleason Works, Rochester, N. Y.

GEAR TESTING MACHINERY
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
National Broach & Machine Co., Detroit, Mich.

GEARS, Cast
Ganschow Gear Co., Chicago, Ill.
Grant Gear Works, Boston, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Perkins Machine & Gear Co., Springfield, Mass.

GEARS, Cut
Adams Co., Dubuque, Iowa
Baush Machine Tool Co., Springfield, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Cincinnati Gear Co., Cincinnati, Ohio
Earle Gear & Machine Co., Philadelphia, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Gear Works, Inc., Chicago, Ill.
Ganschow Gear Co., Chicago, Ill.
Gear Specialties, Inc., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Grant Gear Works, Boston, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Johnson Machine Co., Carlyle, Manchester, Conn.
Massachusetts Gear & Tool Co., Woburn, Mass.
Perkins Machine & Gear Co., Springfield, Mass.

GEARS, Non-Metallic
Chicago Rawhide Mfg. Co., Chicago, Ill.
Massachusetts Gear & Tool Co., Woburn, Mass.
Perkins Machine & Gear Co., Springfield, Mass.

GENERATORS, Acetylene
Air Reduction Sales Co., New York, N. Y.

GREASE
Texas Co., New York, N. Y.

GRINDING MACHINES, Abrasive Belt
Mattison Machine Works, Rockford, Ill.
Production Machine Co., Greenfield, Mass.

GRINDING MACHINE, Attachments
Cincinnati Grinders, Incorporated, Cincinnati, Ohio

GRINDING MACHINES, Bench
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDING MACHINES, Centerless
Cincinnati Grinders, Incorporated, Cincinnati, Ohio

GRINDING MACHINES, Chaser
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Cutter and Tool
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
LeBlond Machine Tool Co., R. K., Cincinnati, Ohio
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDING MACHINES, Cylinder
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Incorporated, Cincinnati, Ohio
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Die
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Heald Machine Co., Worcester, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
Walker Co., O. S., Worcester, Mass.

GRINDING MACHINES, Disc
Production Machine Co., Greenfield, Mass.

GRINDING MACHINES, Drill and Tap
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Oliver Instruments Co., Adrian, Mich.

GRINDING MACHINES, Duplex
Van Norman Machine Tool Co., Springfield, Mass.

GRINDING MACHINES, Face or Ring Wheel
Blanchard Machine Co., Cambridge, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDING MACHINES, Floor
Walker Co., O. S., Worcester, Mass.

GRINDING MACHINES, Gage
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Hydraulic
Cincinnati Grinders, Incorporated, Cincinnati, Ohio

GRINDING MACHINES, Internal
Bryant Chucking Grinder Co., Springfield, Vt.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Rivett Lathe & Grinder, Inc., Boston, Mass.
Thompson Grinder Co., Springfield, Ohio
Walker Co., O. S., Worcester, Mass.

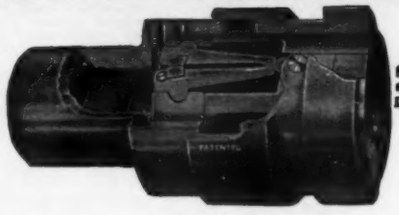
GRINDING MACHINES, Piston Ring
Heald Machine Co., Worcester, Mass.

GRINDING MACHINES, Plain
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Incorporated, Cincinnati, Ohio

GRINDING MACHINES, Radius
Van Norman Machine Tool Co., Springfield, Mass.

GRINDING MACHINES, Roll
Cincinnati Grinders, Incorporated, Cincinnati, Ohio

THE JOHNSON FRICTION CLUTCH



Single Clutch showing working parts.

MODERN PTC GROUP DRIVE

Left — Single Clutch with pulley.

Below — Double Clutch exterior.

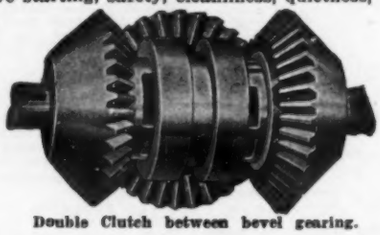
. . for better clutch performance under ANY CONDITIONS

More than thirty years of successful application of JOHNSON FRICTION CLUTCHES to practically all power transmission demands is behind every recommendation made by our Engineering Department.

You can, therefore, depend on better clutch performance regardless of the severity of operating conditions, when you bring your clutch problem to JOHNSON Engineers for study.

Among the operating features which contribute to better performance are sensitive starting, safety, cleanliness, quietness, efficiency and long life.

You incur no obligation in asking us to show specifically how you can improve power transmission on your machines. Just give us the details of your problem.



Double Clutch between bevel gearing.

. . for maximum serviceability in minimum space

The adaptability of JOHNSON FRICTION CLUTCHES to hundreds of different kinds of machines has been possible by the compactness of these sensitive, durable units.

Many leading manufacturers of industrial machinery have standardized on JOHNSON CLUTCHES because their adoption involved minimum changes in design, and assured a maximum in clutch performance.

In addition to compactness, JOHNSON CLUTCHES offer quick, smooth starting. They are available for high speed on light powered drives and can be depended on for safety, durability and economy.

Let us show you how easy it is to engineer the JOHNSON CLUTCH into your machines. Just send us details of how you propose to apply the clutch. Ask for our assistance today.

Write for Blue Clutch Catalog No. 125

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

GRINDING MACHINES, Surface
Blanchard Machine Co., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Heald Machine Co., Worcester, Mass.
Mattison Machine Works, Rockford, Ill.
Pratt & Whitney Co., Hartford, Conn.
Walker Co., O. S., Worcester, Mass.

GRINDING MACHINES, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Incorporated, Cincinnati, Ohio
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond Machine Tool Co., R. K., Cincinnati, Ohio
Thompson Grinder Co., Springfield, Ohio
Van Norman Machine Tool Co., Springfield, Mass.

GRINDING MACHINES, Vertical
Van Norman Machine Tool Co., Springfield, Mass.

GRINDING WHEELS
Atkins, E. C. & Co., Indianapolis, Ind.
Sterling Grinding Wheel Co., Tiffin, Ohio
Vitrified Wheel Co., Westfield, Mass.

HAMMERS, Power
Sellers & Co., Inc., Wm., Philadelphia, Pa.

HAMMERS, Soft-faced
Greene, Tweed & Co., New York, N. Y.

HARDNESS MEASURING INSTRUMENTS, Steel
Shore Instrument & Mfg. Co., Jamaica, L. I., N. Y.
Wilson Mechanical Instrument Co., New York, N. Y.

HOBBING MACHINES
Adams Co., Dubuque, Iowa
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr Co., George, New York, N. Y.

HOBS
Brown & Sharpe Mfg. Co., Providence, R. I.
Union Twist Drill Co., Athol, Mass.

HONING MACHINES
Barnes Drill Co., Rockford, Ill.

HYDRAULIC MACHINERY
Elmes Engineering Works, Chas. F., Chicago, Ill.
Oilgear Co., Milwaukee, Wis.

INDICATORS, Dial
Federal Products Corp., Providence, R. I.

INDICATORS, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R. I.
Veeder-Root, Inc., Hartford, Conn.

JACKS, Planer
Armstrong-Bros. Tool Co., Chicago, Ill.

JOINTS, Universal
Baush Machine Tool Co., Springfield, Mass.
Borgeson Mfg. Co., Torrington, Conn.
Gray & Prior Machine Co., Hartford, Conn.
National Automatic Tool Co., Richmond, Ind.

KEYSEATING MACHINES
Davis Keyseater Co., Rochester, N. Y.
Mitts & Merrell, Saginaw, Mich.
National Machine Tool Co., Cincinnati, Ohio

LAPPING MACHINES, Centerless
Cincinnati Milling Machine Co., Cincinnati, Ohio

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
National Broach & Machine Co., Detroit, Mich.
R & L Tools, Nicetown, Philadelphia, Pa.
Ready Tool Co., Bridgeport, Conn.

LATHES, Automatic and Semi-Automatic
Bullard Co., Bridgeport, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Le Blond Machine Tool Co., R. K., Cincinnati, Ohio
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.

LATHES, Bench
Hardinge Brothers, Inc., Elmira, N. Y.
Le Blond Machine Tool Co., R. K., Cincinnati, Ohio
Rivett Lathe & Grinder Inc., Boston, Mass.
Pratt & Whitney Co., Hartford, Conn.
South Bend Lathe Works, South Bend, Ind.
Starks Tool Co., Waltham, Mass.

LATHES, Engine
American Tool Works Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Le Blond Machine Tool Co., R. K., Cincinnati, Ohio
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio
Niles Tool Works Co., Hamilton, Ohio
Pratt & Whitney Co., Hartford, Conn.
South Bend Lathe Works, South Bend, Ind.
Springfield Machine Tool Co., Springfield, Ohio

LATHES, Horizontal and Vertical Turret
Acme Machine Tool Co., Cincinnati, Ohio
Jones & Lamson Machine Co., Springfield, Vermont
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio

LATHES, Toolroom
American Tool Works Co., Cincinnati, Ohio
Le Blond Machine Tool Co., R. K., Cincinnati, Ohio
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio
Pratt & Whitney Co., Hartford, Conn.
South Bend Lathe Works, South Bend, Ind.
Springfield Machine Tool Co., Springfield, Ohio

LATHES, Vertical Turret
Bullard Co., Bridgeport, Conn.

LATHES, Wheel, R. R.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

LEATHER, Hydraulic
Chicago Rawhide Mfg. Co., Chicago, Ill.

LUBRICANTS
Oakite Products, Inc., New York, N. Y.
Texas Co., New York, N. Y.

LUBRICATING SYSTEMS
Rivett Lathe & Grinder Inc., Boston, Mass.

MACHINE TOOL DRIVES
Cullman Wheel Co., Chicago, Ill.

MARKING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Conn.

MEASURING INSTRUMENTS
Scherr Co., George, New York, N. Y.

MEASURING MACHINES
Hanson-Whitney Machine Co., Hartford, Conn.
Norma-Hoffman Bearings Corp., Stamford, Conn.

MELTING POTS
Hones, Inc., Chas. A., Baldwin, L. I., N. Y.

MICROMETERS
Bath & Co., Inc., John, Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Co., Hartford, Conn.

MILLING ATTACHMENTS
Adams Co., Dubuque, Iowa
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Potter & Johnston Machine Co., Pawtucket, R. I.

MILLING MACHINES, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Pratt & Whitney Co., Hartford, Conn.

MILLING MACHINES, Bench
Pratt & Whitney Co., Hartford, Conn.
Stark Tool Co., Waltham, Mass.

MILLING MACHINES, Continuous
Consolidated Machine Tool Corp., Rochester, N. Y.
Potter & Johnston Machine Co., Pawtucket, R. I.

MILLING MACHINES, Duplex
Cincinnati Milling Machine Co., Cincinnati, Ohio

MILLING MACHINES, Floor Type
Sellers & Co., Inc., Wm., Philadelphia, Pa.

MILLING MACHINES, Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Kent-Owens Machine Co., Toledo, Ohio
Pratt & Whitney Co., Hartford, Conn.

MILLING MACHINES, Manufacturing
Cincinnati Milling Machine Co., Cincinnati, Ohio

MILLING MACHINES, Multiple Spindle
Cincinnati Milling Machine Co., Cincinnati, Ohio

MILLING MACHINES, Plain
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Kent-Owens Machine Co., Toledo, Ohio
Potter & Johnston Machine Co., Pawtucket, R. I.

MILLING MACHINES, Planer Type
Cincinnati Planer Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Niles Tool Works Co., Hamilton, Ohio
Sellers & Co., Inc., Wm., Philadelphia, Pa.

MILLING MACHINES, Precision, Bench
Hardinge Brothers, Inc., Elmira, N. Y.

MILLING MACHINES, Thread
Adams Co., Dubuque, Iowa
Hanson-Whitney Machine Co., Hartford, Conn.
Pratt & Whitney Co., Hartford, Conn.

MILLING MACHINES, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Gorton Machine Co., Geo., Racine, Wis.
Potter & Johnston Machine Co., Pawtucket, R. I.

MILLING MACHINES, Vertical
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Potter & Johnston Machine Co., Pawtucket, R. I.

MILLING MACHINES, Worm
Pratt & Whitney Co., Hartford, Conn.

MOTOR DRIVES
Cullman Wheel Co., Chicago, Ill.

NITROGEN, GAS
Air Reduction Sales Co., New York, N. Y.

NUMBERING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Conn.

NUT TAPPERS (see Bolt & Nut Machinery)

OIL AND GREASE CUPS
Gits Bros. Mfg. Co., Chicago, Ill.

OIL GROOVING MACHINES
National Machine Tool Co., Cincinnati, Ohio

OIL SEALS
Chicago Rawhide Mfg. Co., Chicago, Ill.

OILS, Lubricating
Texas Co., New York, N. Y.

OXYGEN, GAS
Air Reduction Sales Co., New York, N. Y.

DIE CUTTING AND THREADING MACHINES
Landis Machine Co., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, Ohio
Murchey Machine Tool Co., Detroit, Mich.

PIPE FITTERS, TOOLS
Butterfield & Co. (Div. of Union Twist Drill Co.), Derby Line, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.

PLANING MACHINES
American Tool Works Co., Cincinnati, Ohio
Cincinnati Planer Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Niles Tool Works Co., Hamilton, Ohio
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Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Machine Co., New Britain, Conn.
Production Machine Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.

PRESS FEEDS
V & O Press Co., Hudson, N. Y.

PRESSES, Forcing
Elmes Engineering Works, Chas. F., Chicago, Ill.
Lucas Machine Tool Co., Cleveland, Ohio
Oilgear Co., Milwaukee, Wis.

PRESSES, Hydraulic
Elmes Engineering Works, Chas. F., Chicago, Ill.
Oilgear Co., Milwaukee, Wis.

PRESSES, Power
Cincinnati Shaper Co., Cincinnati, Ohio
Oilgear Co., Milwaukee, Wis.
V & O Press Co., Hudson, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PROFILING MACHINES
Gorton Machine Co., Geo., Racine, Wis.

PROTRACTORS
Lufkin Rule Co., Saginaw, Mich.

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Johnson Machine Co., Carlyle, Manchester, Conn.

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Elmes Engineering Works, Chas. F., Chicago, Ill.
Oilgear Co., Milwaukee, Wis.

PUMPS, Lubricants and Oil
Brown & Sharpe Mfg. Co., Providence, R. I.
Tomkins-Johnson Co., Jackson, Mich.

PUMPS, Portable

PUNCHES, Center and Hand
Armstrong-Blum Mfg. Co., Chicago, Ill.
Lufkin Rule Co., Saginaw, Mich.

PUNCHES, Power
Mitts & Merrell, Saginaw, Mich.

PUNCHING AND SHEARING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Kent-Owens Machine Co., Toledo, Ohio

REAMERS, Adjustable
Apex Machine & Tool Co., Dayton, Ohio
Gammons-Holman Co., Manchester, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.

REAMERS, Solid
Apex Machine & Tool Co., Dayton, Ohio
Butterfield & Co. (Div. of Union Twist Drill Co.), Derby Line, Vt.
Gammons-Holman Co., Manchester, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Holman Reamer Co., Manchester, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.

REAMING MACHINES
Van Norman Machine Tool Co., Springfield, Mass.

RIVETING MACHINES
Grant Mfg. & Machine Co., Bridgeport, Conn.
Linley Brothers Co., Bridgeport, Conn.

RULES, Steel and Wood
Lufkin Rule Co., Saginaw, Wis.

RUST PREVENTIVES
Oakite Products, Inc., New York, N. Y.

SANDERS
Mattison Machine Works, Rockford, Ill.

SAWING MACHINES, Band
Armstrong-Blum Mfg. Co., Chicago, Ill.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., Chicago, Ill.
Atkins, E. C. & Co., Indianapolis, Ind.
Earle Gear & Machine Co., Philadelphia, Pa.

SAWS, Band
Atkins, E. C., & Co., Indianapolis, Ind.

SAWS, Circular Metal Cutting
Atkins, E. C. & Co., Indianapolis, Ind.

SAWS, Circular Wood Cutting
Atkins, E. C. & Co., Indianapolis, Ind.

SAWS, Hack
ArmstrongBlum Mfg. Co., Chicago, Ill.

SAWS, Milling
Atkins, E. C. & Co., Indianapolis, Ind.
Union Twist Drill Co., Athol, Mass.

SAWS, Screw Slotting
Atkins, E. C. & Co., Indianapolis, Ind.
Union Twist Drill Co., Athol, Mass.

SCREW DRIVERS, Automatic
Errington Mechanical Laboratory, Staten Island, N. Y.

SCREW EXTRACTORS
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREW MACHINE, TOOLS AND ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R. I.

SCREW MACHINE WORK
Eastern Machine Screw Corp., New Haven, Conn.
National Machine Tool Co., Cincinnati, Ohio
New Britain-Gridley Machine Co., New Britain, Conn.

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Cone Automatic Mach. Co., Windsor, Vt.
New Britain-Gridley Machine Co., New Britain, Conn.

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Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland, Ohio

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SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties Co., Inc., Chicago, Ill.
Eastern Machine Screw Corp., New Haven, Conn.

SCREWS, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Machine Screw Corp., New Haven, Conn.

SHAFTING
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SHAFTS, Flexible
Strand & Co., N. A., Chicago, Ill.

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Cincinnati Shaper Co., Cincinnati, Ohio
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Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Springfield Machine Tool Co., Springfield, Ohio

SHEARS, Power
Cincinnati Shaper Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Mitts & Merrell, Saginaw, Mich.

SHEET METAL WORKING MACHINERY
Cincinnati Shaper Co., Cincinnati, Ohio

SLOTTING MACHINES
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Grant Gear Works, Boston, Mass.
Hartford Special Machinery Co., Hartford, Conn.

SPROCKETS
Cullman Wheel Co., Chicago, Ill.
Grant Gear Works, Boston, Mass.

SQUARES
Lufkin Rule Co., Saginaw, Mich.

WHERE-TO-BUY DIRECTORY

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Noble & Westbrook Mfg. Co., Hartford, Conn.

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Ryerson & Sons, Jos. T., Chicago, Ill.

STEEL, Cold Finished
Ryerson & Sons, Jos. T., Chicago, Ill.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

STEEL, Rustless and Stainless
Ryerson & Sons, Jos. T., Chicago, Ill.
Wyckoff Drawn Steel Co., Pittsburgh, Pa.

STEEL, Setters
Errington Mechanical Laboratory, Staten Island, N. Y.

STEEL, Tool
Ryerson & Sons, Jos. T., Chicago, Ill.

STEELS, Alloy, Carbon and High Speed
Latrobe Electric Steel Co., Latrobe, Pa.

STRAIGHTENING MACHINERY
Springfield Machine Tool Co., Springfield, Ohio

SUB PRESSES AND DIES
Danly Machine Specialties Co., Inc., Chicago, Ill.

SWAGING MACHINES
Torrington Co., Torrington, Conn.

TAP EXTENSIONS
Allen Mfg. Co., Hartford, Conn.

TAP EXTRACTORS, Broken
Walton Co., Hartford, Conn.

TAP HOLDERS
Errington Mechanical Laboratory, Staten Island, N. Y.

TAPER PINS
Morse Twist Drill & Machine Co., New Bedford, Mass.

TAPES, Measuring
Lufkin Rule Co., Saginaw, Mich.

TAPPING MACHINES AND ATTACHMENTS
Acme Machinery Co., Cleveland, Ohio
American Tool Works Co., Cincinnati, Ohio
Errington Mechanical Laboratory, Staten Island, N. Y.
Kingsbury Machine Tool Corp., Keene, N. H.
Murchey Machine Tool Co., Detroit, Mich.
National Automatic Tool Co., Richmond, Ind.

TAPS AND DIES
Bath & Co., Inc., John, Worcester, Mass.
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Card Mfg. Co., S. W. (Division Union Twist Drill Co.) Mansfield, Mass.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.

TAPS, Collapsing
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine Tool Co., Detroit, Mich.

TAPS, Ground
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Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Morse Twist Drill & Machine Co., New Bedford, Mass.

TESTING APPARATUS, Hardness
Shore Instrument & Mfg. Co., Jamaica, L. I., N. Y.
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THREAD-CUTTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastern Machine Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine Tool Co., Detroit, Mich.
Waltham Machine Works, Waltham, Mass.

THREAD-CUTTING TOOLS
Eastern Machine Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Murchey Machine Tool Co., Detroit, Mich.

TOOL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.
Ready Tool Co., Bridgeport, Conn.

TOOL POSTS, Lathe
Armstrong Bros. Tool Co., Chicago, Ill.

TOOLS, Carbide Alloy
Carboloy Co., Detroit, Mich.

TOOLS, Cutting-Off
Armstrong Bros. Tool Co., Chicago, Ill.

TOOLS, Diamond
Desmond-Stephan Mfg. Co., Urbana, Ohio

TOOLS, Turning
R & L Tools, Nicetown, Philadelphia, Pa.

TRANSMISSION
Oilgear Co., Milwaukee, Wis.

TUBING, Seamless
Ryerson & Sons, Jos. T., Chicago, Ill.

TURRET MACHINES (see Lathes, Horizontal Turret)

TURRETS, Tool Post
American Tool Works Co., Cincinnati, Ohio

UNIVERSAL JOINTS
Apex Machine & Tool Co., Dayton, Ohio

USED MACHINERY (see Searchlight Section)
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Bernstein & Co., G. M., Chicago, Ill.
Cincinnati Machinery & Supply Co., Cincinnati, Ohio
Eastern Machinery Co., Cincinnati, Ohio
Emerman & Co., Louis E., Chicago, Ill.
Howarth Machinery Co., C. C., Detroit, Mich.
Hill Clarke Machinery Co., Chicago, Ill.
Hyman & Sons, Jos., Philadelphia, Pa.
Indianapolis Machy. & Supply Co., Indianapolis, Ind.
Industrial Machinery Co., Indianapolis, Ind.
Interstate Machinery Co., Chicago, Ill.
Iroquois Mchy. Co., Buffalo, N. Y.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Marr-Galbreath Machy. Co., Pittsburgh, Pa.
Miles Machinery Co., Saginaw, W. S., Mich.
Monarch Machinery Co., Philadelphia, Pa.
Morey & Co., Inc., New York City, N. Y.
Morris Machinery Co., Newark, N. J.
Motor Repair & Mfg. Co., Cleveland, Ohio
O'Brien Machinery Co., Philadelphia, Pa.
Ott Machinery Sales Co., Detroit, Mich.
Riverside Machy. Depot, Detroit, Mich.
Simmons Mach. Tool Corp., Albany, N. Y.
Standard Machinery & Supply Co., Inc., Boston, Mass.
Strong, Carlisle & Hammond Co., Cleveland, Ohio
Sun Machinery Co., Inc., Newark, N. J.

VALVES
Elmes Engineering Works, Chas. F., Chicago, Ill.

VISES, Drilling Machine
Armstrong-Blum Mfg. Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Hartford Special Machinery Co., Hartford, Conn.

VISES, Machinist
Desmond-Stephan Mfg. Co., Urbana, Ohio

VISES, Milling Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio
Hartford Special Machinery Co., Hartford, Conn.

VISES, Pipe
Butterfield & Co. (Div. of Union Twist Drill Co.). Derby Line, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass.

VISE STANDS
New Britain-Gridley Machine Co., New Britain, Conn.

WELDING RODS
Ryerson & Sons, Jos. T., Chicago, Ill.

WELDING SUPPLIES
Air Reduction Sales Co., New York, N. Y.

WORM DRIVES
Gear Specialties, Inc., Chicago, Ill.
Hartford Special Machinery Co., Hartford, Conn.
Perkins Machine & Gear Co., Springfield, Mass.

WORMS
Gear Specialties, Inc., Chicago, Ill.

WRENCHES, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.

WRENCHES, Ratchet
Greene, Tweed & Co., New York, N. Y.

WRENCHES, Tap
Butterfield & Co. (Div. of Union Twist Drill Co.). Derby Line, Vt.
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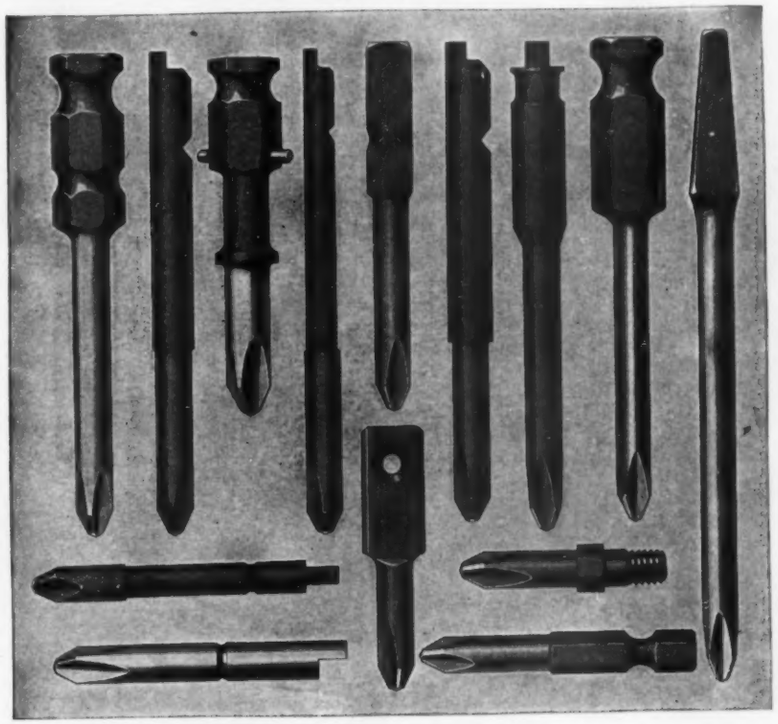
Announcing **APEX-PHILLIPS SCREW DRIVER BITS**

FOR PHILLIPS RECESSED HEAD SCREWS



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